THE AMERICAN GAS LIGHT JOURNAL

VOL. CIV., No. 8. NEW YORK, FEBRUARY 21, 1916. WHOLE No. 3,024.

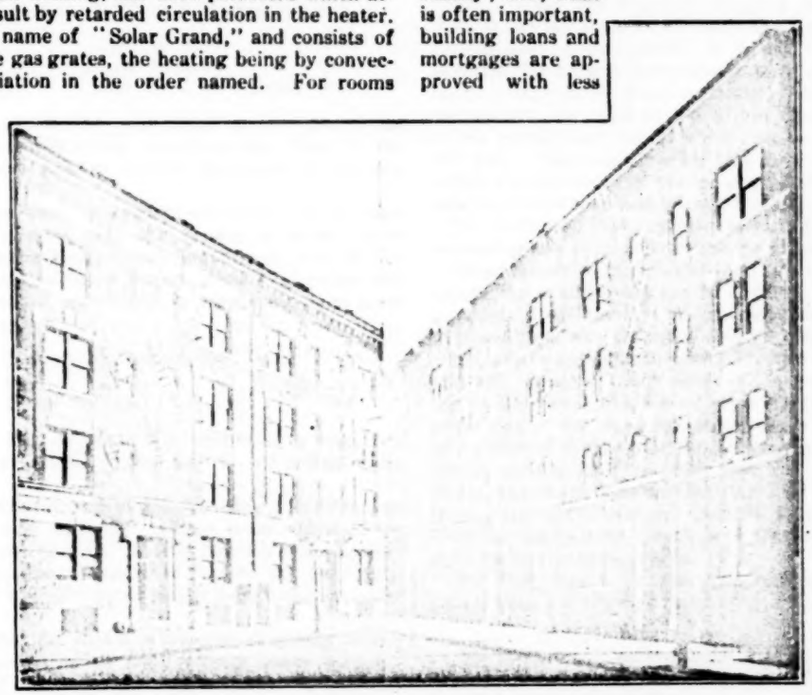
GAS FIRED, HOT AIR, CIRCULATING HEATERS.

Heating Apartment Houses with City Gas.

[This is the second of a series of articles by MR. H. THURSTON OWENS, showing *how* gas is used in the equipment of Modern Buildings.]

Hot air circulating heating systems, using coal, date back further than this generation, and are used to a large extent for heating private dwellings. For a number of years they have been gradually superseded by steam and hot water systems, mainly because with these latter the heat could be stored and the circulation retarded.

A gas system, for hot air heating, has been perfected which accomplishes the desired result by retarded circulation in the heater. It is known by the trade name of "Solar Grand," and consists of individual, luminous flame gas grates, the heating being by convection, conduction and radiation in the order named. For rooms where there are no fireplaces, portable heaters, operating upon the same principle, are available.

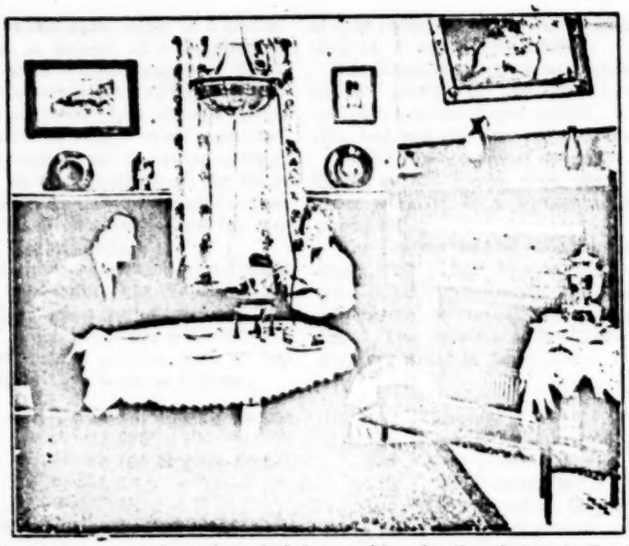


Types of Apartment Buildings in Brooklyn, heated with Hot Air Gas Heaters.

The test of time necessary for sound judgment as to the success of a system, is not lacking in this case, as many installations have been in use for a number of years. The apartment buildings illustrated may be cited as typical of a number of examples found in Brooklyn, New York City, and the architect, Mr. Charles Weber, of 148 Schaeffer street, Brooklyn, who is also the owner and builder, gives the following as some of his reasons for adopting this heating system:

"In medium priced apartments, the heating problem is one of considerable expense, both as regards installation and maintenance, and still my experience has been that a building with permanent individual heating equipment can be rented easier, and sells more readily; and, what is often important, building loans and mortgages are approved with less trouble when buildings are so equipped. The matter of janitor service becomes a more expensive item each year, as well as a vexing one; and any heating system that cuts down the labor will be looked upon with added merit. It has been found that the tenants in medium priced apartments understand the meaning of thrift, perhaps because it comes into the woman's province, and this makes individual "Gas Fires" possible. All heating systems should be operated with economy, but those using expensive

The piping necessary to prepare these buildings for gas heating was such a small part of their cost, less than one-half of one per cent., that all buildings should be piped.



In this home, gas is used for lighting, cooking, heating, hot water heating and for small appliances. It is piped throughout.

fuels *must* be. The apartments that we have equipped with this system of heating are arranged so that the heater in the dining room takes care of that room, the living room, the bed room and the bath. The kitchens are equipped with combination gas and coal ranges, and the halls are heated by a portable heater placed upon the first floor. We have checked the gas consumption and find that the results obtained amply justify our faith in the care the tenants would give to the operation of the heaters. The average expense of a number of apartments, with 80 cent gas, during the months of January, February and March, was less than $2.50 a month."

Construction of the Heaters.

The hot air circulating heaters used, illustrated herewith, are equipped with luminous flame burners, the products of combustion from which are baffled and retarded, so that they come out into the room slowly and as near the floor as is feasible. The burners are aluminum pipe with drilled holes, and the temperature in the combustion chamber is so high that the combustion is furthered and completed, no carbon deposits upon the interior metal surfaces being found. The heaters contain about 6 square feet of radiating surface which adds to the heating capacity.

The secret of the success of these heaters is in the method of retarding the circulation. This feature is essential in order to transfer the heat from the products of combustion to the surrounding media in the lower part of the room. The natural tendency of heat to rise makes any form of heater not baffled less efficient, if they depend upon convected heat for their results.

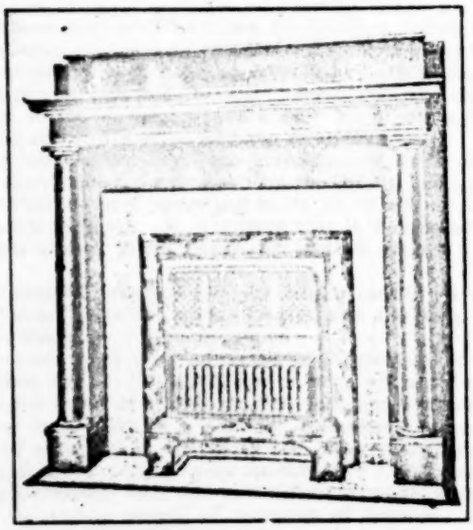
In all heating systems the problem is to displace the cold air throughout the room with hot air; the heated air naturally rises, and the lower down in the room the change is effected the greater will be the efficiency of the system. The slower the conversion the greater the efficiency.

Design and Appearance.

After efficiency and perfect combustion, comes appearance. Perhaps it even comes before, but whether or no, it is very important. One of the chief aims in designing is unobtrusiveness, and how successfully this is accomplished may be judged by the installations illustrated. Books have been written about fireplaces, about their lines, ornaments, period and character; and volumes could be written about fireplaces that did not work.

In these heaters the design is unobtrusive, and gas the *dependable* product, is always ready. This fireplace will work; it does not give off an odor, and you don't have to carry fuel to it. Flues are not necessary, although they may be used.

You can have heat when you want it, the expense will be small, your aesthetic feelings will not be outraged, you can be comfortable; and that's one road to happiness.



Solar Grand Mantel type luminous flame Circulating Hot Air Gas Heaters.

Sectional View.

A—Combustion Chamber

B—Aluminum Pipe Burner

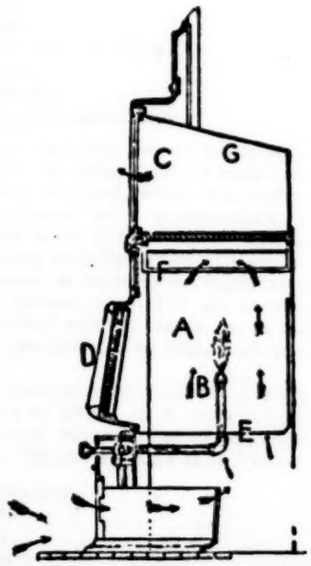
C—Hot Closet

D—Grate Section

E—Perforated Apron

F—Baffling Plates and Pockets regulating circulation

G—Asbestos Insulation



The cold air drawn in at the bottom is heated, its progress retarded by baffle plates, and it is then discharged slowly into the room.

THE ORIGIN OF ENGLISH MEASURES OF LENGTH.

SIR CHARLES M. WATSON, in "Journal of the Royal Society of Arts."

Although there is considerable variety in the measures of length used by different nations, there can be no doubt that they are derived from a common origin so remote that the date of their invention has been completely lost. But the original measures are a matter of considerable historical importance, and the question can be investigated by an examination of the changes made by the people who have adopted them—changes, in some cases, apparently due to accident rather than design.

For the sake of clearness, it is convenient to divide the measures of length into four categories:

(1) The shorter measures of length, used for building and manufacturing purposes, of which the more important in ancient times were the cubit, the palm, and the digit or finger breadth, of which the English representatives are the yard, the foot, and the inch. (2) The shorter measures, such as the foot, the yard, and the pace. (3) The measures of distance, including the stadium, the mile, the parasang, the schoenos, the league, the hour's march, and the day's march. (4) Measures used in the calculation of land areas, of which the English representatives are the perch, the chain, and the furlong.

It is generally accepted that the first of these classes was based on the proportions of the human body, so that every man had his own scale. As, however, men are not all of the same size, there is considerable variety in the length of the different units, but they may be included within the following limits:

The digit	or finger breadth	from 0.72	to 0.75	English	inch.
The palm,		" 2.88	to 3.00	"	inches.
The cubit,		" 17.28	to 18.00	"	"
The fathom,		" 5.50	to 6.00	English	feet.

The palm is the width across the open hand at the base of the fingers; the cubit is the length of the arm from the elbow to the end of the middle finger; and the fathom the length of the outstretched arms.

There is no record as to when an attempt was first made to combine the measures in a standard scale, but it was probably at an early period, as it must have been inconvenient for workers on the same building, for example, to use different lengths of palms and cubits; and, when a standard was fixed, it may have been some such scale as the following:—

	1 digit	= 0.7375	English	inch.
4 digits	= 1 palm	= 2.95	"	inches.
6 palms	= 1 cubit	= 17.70	"	"

The cubit of this scale may be called the "cubit of a man," to distinguish it from other cubits, which will be described hereafter.

In process of time it was found desirable to have a smaller unit than the digit, and this was made by taking it as equal to six grains of barley placed side by side. In the English scale, barleycorns were used as the smallest measure of length, but they were placed end to end, three barleycorns so placed being taken as equal to one inch.

There is no evidence that the foot was included originally among the units of the hand worker, and it may, perhaps more properly be regarded as belonging to the second class of measures, derived from the distance covered by a man walking, and as a subdivision of the important unit, the pace. The pace is of two kinds, the single pace, or distance covered by the step of one foot, and the double pace, the distance covered by both feet one after the other.

The Roman double pace, a very important measure, was taken as equal to five feet, but this was an artificial connection, as there is no fixed proportion between the length of a man's foot and the length of his pace. There is nothing to show when the foot was added to the units of the mechanic's scale, but when this was done it was assumed to be equal to four palms, or two-thirds of a cubit.

The third class of measures of length is the most important, and their history is of particular interest, as they appear to have been first used by a people who possessed a high degree of astronomical and mathematical knowledge, who were acquainted with the form of the earth, and able to carry out accurate geodetical measurements. It is also remarkable that the changes made in these measures, in the course of time, have been for the worse, in consequence, apparently, of their origin having been forgotten. There is no doubt that they are based on the angular division of the circle, and on the application of this division to terrestrial measurements.

The unit of angular measurement is the angle of an equilateral triangle, divided by the ancient geometricians, for the purposes of calculation, into 60 ′, the best number possible, as 60 = 3 × 4 × 5.

Following the same principle, each degree was divided into 60 minutes, and each minute into 60 seconds. As the circle contains six times the angle of an equilateral triangle the circle was 360 °. This division of the circle, although so ancient that its origin is unknown, has never been improved upon, and is still in use by all nations. An attempt by French mathematicians to substitute a division of the circle into 400 °, on account of the supposed advantages of the decimal system, proved a failure.

The manner in which the division of the circle into 360 ° was used by the ancients to determine the unit for terrestrial measures of distance was as follows: If a circle be described cutting the equator of the earth at right angles, and passing through the north and south poles, its circumference in angular measurement is 360 °. 60 ′ = 21,600 ″, and the length of 1 minute, measured on the surface of the globe was taken as the unit, called a geographical mile at the present time. If the earth was a perfect sphere, every geographical mile would be of the same length, but, as the polar diameter is less than the equatorial diameter in the proportion of 7,900 to 7,926, the length of the geographical mile on the meridian, is not the same in all latitudes, but increases from 6,046 English feet at the equator to 6,108 English feet at the poles. Whether the ancient astronomers were acquainted with this irregularity in the figure of the earth it is not possible to say, but it is certain that the value at which they fixed it must have been close to the actual mean value, which may be taken as about 6,075 English feet. The Greek stadion (the same as the Roman stadium), which was one-tenth of the geographical mile, was 600 Greek feet and the Greek foot was about 12.15 of our present English inches.

The next step taken appears to have been with the view of assimilating the subdivions of the geographical mile with the cubit.

This appears to have been done by the invention of two new cubits, the smaller very nearly equal to the cubit of a man, and contained 4,000 times in the geographical mile. This, for the sake of distinction, may be called the geographical cubit. The second cubit, afterwards known as the Babylonian Royal cubit, was longer, and was contained 3,600 times in the geographical mile. According to Herodotus this second cubit was three digits longer than the other cubit. On these two cubits there appear to have been based two different divisions of the geographical mile, one in accordance with a decimal, and the other with a sexagesimal system of calculation, but there is no ancient record of these scales, and the following attempt to compose them is founded on inferences, drawn from the Babylonian, Greek and Roman measures, all of which came from the same origin.

The first, based on the geographical cubit, which was rather longer than the average cubit of a man, is as follows:—

	1 digit	= 0.729	English	inch.
25 digits	= 1 geographical cubit	= 18.225	"	inches.
100 "	= 1 fathom	= 6.075	English	feet.
100 fathoms	= 1 stadion	= 607.5	"	"
10 stadia	= 1 geographical mile	= 6075	"	"

The second, or sectional scale, based on the Babylonian Royal cubit, appears to have been as follows:

	1 digit	= 0.723	English	inch
28 digits	= 1 Royal cubit	= 20.25	"	inches
60 cubits	= 1 plethron	= 101.25	"	feet
60 plethra	= 1 geographical mile	= 6,075	"	"

There was another Babylonian measure of length called the gar, used for land measurements, which appears to have been composed of 12 Royal cubits. It was the ancester of the English land measure, the perch, which is 11 English cubits in length.

The ancient Egyptian measures of length, although evidently derived from the same origin as the Babylonian, differ in some respects. The most important smaller unit was the Egyptian Royal

cubit, which was divided into seven palms, each palm of 4 digits. The approximate length of this cubit is known, as a number of cubit scales have been found which give a mean length of 20.65 English inches, and an examination of the monuments of Egypt shows that this cubit was used for building purposes from ancient times.

As is generally the case with measures of length in all countries, the Egyptian cubit appears to have grown longer in course of time; a good instance of this being shown by a comparison of the three nilometers on the island of Philæ, above Assuan, of which the first gives a mean value for the cubit of 20.47 English inches, the second of 20.81, and the third of 21.05 English inches.

It is a matter of controversy whether the Greeks derived their measures of length from Egypt or Babylonia; but the latter appears more probable, as their principal measure of distance, the stadion, was equal to one-tenth of a geographical mile of 6,075 English feet; and this was divided into 6 plethra, each of 100 Greek feet. The Greek scale appears to have been as follows:

	= 1 Greek foot	= 12.16	English inches
1½ Greek ft.	= 1 cubit	= 18.225	" "
10 Greek ft.	= 1 reed	= 10.125	English feet
10 reeds	= 1 plethron	= 101.25	" "
6 plethra	= 1 stadion	= 607.50	" "
10 stadia	= 1 geographical mile	= 6,075	" "

There was another foot used in Greece, varying from 11.43 to 11.74, with a mean value of 11.60 English inches. This would appear to be a foot of 16 digits, used for building and manufactures, but not connected with measures of distance.

The Roman system of measures was based on the Greek, but while adopting the stadion—called by them stadium—as the fundamental measure of distance, they used the shorter Greek foot, and introduced another measure, the double pace. They also made the land mile to consist of 8 instead of 10 stadia, while retaining the geographical mile of 10 stadia for use at sea. As they had an affection for a duodecimal system of calculation, they also divided the foot into 12 inches, in addition to the old division into 16 digits. The roman scale, which showed considerable ingenuity in assimilating a number of different measures that had no real relationship to one another, appears to have been as follows:

	= 1 digit	= 0.729	English inch
	= 1 inch	= 0.972	" "
4 digits or 3	= 1 palm	= 2.916	" inches
4 palms	= 1 foot	= 11.664	" "
6 "	= 1 cubit	= 17.496	" "
5 feet	= 1 pace	= 4.86	" feet
125 paces	= 1 stadion	= 607.5	" "
8 stadia	= 1 land mile	= 4,860	" "
10 stadia	= 1 geographical or sea mile	= 6,075	" "

The land mile was probably made of 8 stadia, in order to have it exactly 1,000 paces in length, or it may have been considered that 8 was a more convenient number for dividing than 10; but it was necessary to retain the mile of 10 stadia for navigation.

In addition to these measures of distance, there are certain longer measures, such as the parasang, the schoenos, and the league. The fundamental idea of these was that they represented the distance that could be marched in a given time, such as one hour; and as the rate of marching naturally varied with the nature of the country, it was not easy to have a fixed length, and a theoretical unit did not always agree with the actual distance.

In Egypt the measure of distance corresponding to the parasang was the "ater," called "schoenos" by the Greeks, and stated by different writers to have been equal to 30, 32, 40 and 60 stadia in different parts of Egypt. It is evident that it was based on the geographical mile as a rule, while 32 stadia is equal to 4 Roman miles.

Another longer measure of distance, largely used in the western parts of Europe under the Roman Empire, was the Gallic league, equal to 12 stadia, or 1½ Roman miles.

An important application of measures of distances, from the earliest times, was for the calculation of areas of land, but there is considerable doubt as to the original unit, and whether it was a square, or in the form of a rectangle one stadium in length and one-tenth of a stadium in width. In the latter case there would have been 10 measures in a square stadium, and 1,000 measures in a square geographical mile, and such a measure would seem in accord with the ancient system of measures of distance. Its area would have been 40 × 400 geographical cubits (36 × 390 Babylonian Royal cubits), or 0.847 English statute acre. There is a very widely distributed type of land measures based on a rectangle of this form, of which the English acre is an instance, as it measures 44 × 440 English cubits.

The Egyptian unit of land areas appears to have been the "set," called "arura" by the Greeks, which was a square having a side of 100 Egyptian Royal cubits. A cubit of land was the $\frac{1}{100}$ part of this, and was the area of a rectangle 1 × 100 cubits.

In the Greek system, the unit of area was the square of a plethron, or 100 Greek feet, equal to 0.235 English acre, of which there were 36 in a square stadion, and 3,600 in a square geographical mile.

The Roman unit of mile area, called the "jugerum," was a rectangle, 120 × 240 Roman feet, or 0.624 English acre, which was subdivided duodecimally, the uncia of land being the 12th part of a jugerum, or the area of a rectangle measuring 10 × 240 Roman feet. The relative proportions of these different units of land area are given in table below.

Area of Unit.	Number contained in Geographical Mile.	Area in English Statute Acres.
36 × 360 Babylonian Royal cubits...	1,000	0.847
100 × 100 Greek feet.....	3,600	0.235
120 × 240 Roman feet.....	1,356	0.624
100 × 100 Egyptian Royal cubits.....	1,240	0.683
Geographical square mile..	1	847.238
English square mile.. ...	1.324	640

It will be seen from these discriptions that, from the earliest times the shorter measures of length were based on the proportions of the human body, and the longer on the geographical mile; and that at some remote period an attempt was made to combine them into a continuous scale, from the digit to the geographical mile. When the digit was made the point of departure, the decimal system of calculation appears to have been preferred; and when the scale was worked downwards from the mile the sexagesimal system was the most convenient, while in the Roman scale the duodecimal system was introduced.

The modern measures of the civilized world are, with few exceptions, based on the ancient units. Of these exceptions the most important are the measures of the metric system, which were designed with the object of breaking away from the past by the adoption of a new geographical mile, equal to $\frac{54}{100}$ of the true geographical mile.

The English measures of length are a good example of the modern representatives of the old units, and are worthy of study from this point of view. How the measures originally came to England it is not easy to say, but they were in use before the Roman invasion, having possibly been introduced by Phœnician traders, and afterwards modified by the Romans, the Saxons, the Scandinavians, and the Normans, each of whom had measures based on the old units. It was not until the thirteenth century that they were moulded by law into one uniform system.

The English scale, as authorized by statute, may be summarized as follows:

		1 inch.
12	inches	= 1 foot.
3	feet	= 1 yard.
5½	yards	= 1 rod pole, or perch.
4	perches	= 1 chain.
10	chains	= 1 furlong.
8	furlongs	= 1 English statute mile.

Of these units the inch is derived from the Roman, being one-twelfth of the foot, but the foot, on the other hand, is equal approximately to the Greek foot, while the yard, which is a double cubit, comes from the Babylonian system, being approximately a double geographical cubit. The perch is the English representative of the Babylonian gar, and the furlong occupies a similar place to the stadium, while the mile is composed of eight stadia, apparently in imitation of the division of the Roman mile. For use at sea, however, the geographical mile, divided into ten stadia, or, as we call them, cable lengths, has been retained, as no other mile can be used for purposes of navigation.

In order to fully understand the connection between the English measures and the ancient measures of length, it is necessary to write the scale in a somewhat different manner, and to introduce some units that are no longer used. The revised scale is as follows:

		1 barleycorn.
3	barleycorns	= 1 inch.
3	inches	= 1 palm.
4	palms	= 1 foot.
6	"	= 1 cubit.
12	"	= 1 double cubit or yard.

11 cubits	= 1 perch.
405 "	= 1 cable's length.
4 perches	= 1 acre's breadth or chain.
10 chains	= 1 acre's length or furlong.
8 furlongs	= 1 English mile.
10 cables	= 1 geographical, or sea mile.

The English inch is equal to 3 barleycorns set end to end, or to the width of 8 barleycorns, set side by side. The barleycorn, as a measure, is forgotten, but the inch on carpenters' rulers is still divided into eight parts, while, on a shoemaker's tape, the sizes of boots and shoes increase by a barleycorn, or $\frac{1}{3}$", for every size. For example: Size No. 8 of a man's boot measures 11 inches; size No. 9, $11\frac{1}{3}$"; size No. 10, $11\frac{2}{3}$", and so on.

The palm, which was originally 4 digits or finger breadths, and, since the time of the Romans, 3" or thumb breadths, is no longer used in England, and its place has been taken by a measure called the hand, composed of 4" and employed in measuring the height of horses. The change may have been due to the fact that the number 4 was more convenient for division than 3, and that when the digit gave way to the inch the palm of 4 digits was replaced by the hand of 4".

Prior to the thirteenth century, the length of the foot in England was uncertain, and there appear to have been several measures in use, varying from the Roman foot of 11.66 English inches to the Belgic foot of 13.12 English inches; but, by the Ordinance known as the Statute for Measuring Land, enacted in the reign of Henry III., the relations of the inch, the foot, and the cubit to one another were definitely fixed, and have never since been altered. The cubit of this Statute is the double cubit, afterwards called the yard. A translation of the Latin of the Statute, describing the measures, is as follows:

"It is ordained that 3 grains of barley, dry and round, make an inch; 12 inches make a foot; 3 feet make a cubit; $5\frac{1}{2}$ cubits make a perch; 40 perches in length and 4 perches in breadth make an acre.

"And it is to be remembered that the iron cubit of our Lord the King contains 3 feet and no more; and the foot must contain 12 inches, measured by the correct measure of this kind of cubit; that is to say, one thirty-sixth part of the said cubit makes 1 inch, neither more nor less. And $5\frac{1}{2}$ cubits, or $16\frac{1}{2}$ feet, make one perch, in accordance with the above-described iron cubit of our Lord the King."

It is interesting that, in this Statute, the double cubit, thus accurately described, is called the cubit of the King, just as the longer cubits of Babylon and of Egypt were called Royal cubits to distinguish them from the shorter cubits of those countries. In the Latin original of the Ordinance the word used is "ulna," the usual word for cubit. The word "yard" occurs for the first time in the laws of England in a Statute of 1483.

The two measures, the acre's breath, afterwards called the chain, and the acre's length or furlong, have also been used from a very early period. The former is equal to 44 single cubits, 22 yards, or 66 English feet, while the latter is exactly ten times this, 440 cubits, 220 yards, or 660 feet. The furlong is the modern representative of the ancient stadium, which had a length of 600 Greek feet, or 607.5 English feet, but the reason for its being longer than the stadium has not been satisfactorily explained. The change may have been due to the fact that other measures of distance were in use in England prior to the present statute mile, which varied in different parts of the country, and the mean of these was approximately equal to the Gallic league of 12 stadia or 7,290 English feet. One-eleventh of this, 663 English feet, is approximately equal to the English furlong, and eight of these measures, following the Roman system, were combined to form the English statute mile.

There was another measure of distance used in England, known as the leuga, composed of 12 furlongs, which corresponded to the Gallic league of 12 stadia already described. In the Chronicles of Battle Abbey, which extend over the period A.D. 1067-1176, in the account of the lands belonging to the abbey, the following statement occurs: "The English leuga contains 12 roods (furlongs), and 40 perches makes one rood; the perch is 16 feet in length; the acre is 40 perches in length and 4 in breadth; but if it is 20 perches in length, it shall be 8 in breadth." The acre's length, here called rood, and the acre's breadth appear to have been the same as in the time of King Athelstane, and the foot is the Saxon foot, equal to 12.375 of our present inches. The measurement of the acre, 4 × 40 perches, is the same as that given in the Statute for Measuring Land enacted in the reign of Henry III., which has already been referred to.

The terms acre's length and rood are no longer used, and this measure is now known as the furlong, while the acre's breadth has been called the chain since the beginning of the seventeenth century, when it was divided into 100 links instead of 66 feet. The chain, which was the invention of Professor Gunter, has proved very convenient for the measurement of land acres, and is now always used.

Since the introduction of the chain, the perch or rod has been less employed in connection with land measures, but is still used by builders for the measurement of brickwork. The common English stock brick is half a cubit in length, one-quarter of a cubit in width, and one-sixth of a cubit in thickness, or rather less than these dimensions, to allow for the thickness of the mortar joints, while a rod of brickwork is a mass one rod or 22 bricks in length, one rod or 66 bricks in height, and three bricks in thickness, and contains 4,356 bricks.

The English sea mile is exactly the same as the geographical mile of the Babylonian system, and its tenth part, the cable length, is identical with the stadium. In these measures there has been no change, and the only difference is that the cable length is 405 English cubits, whereas the stadium was 400 original cubits. This is due to the fact that the English cubit is a little shorter than the latter in consequence of the English foot, as fixed by law, being rather less than $\frac{1}{6080}$ part of the geographical mile.

It will be seen from this that the English measures of length are no haphazard modern invention, but have come down from prehistoric times.

One City's Gas Business.

[From an Article in "Gas Logic."]

It is impossible for the ordinary gas consumer to form anything but a vague idea of the immensity of the detail work carried on each day in the year by the Consolidated Gas Company in Manhattan and The Bronx. Probably nine-tenths of the Company's customers never give a thought to the meaning of furnishing an adequate and constant supply of gas—night and day, year in and year out—on which probably 4,500,000 persons are daily dependent.

During the year 1915, representatives of the gas company made nearly 28,000,000 visits to the homes or places of business of gas consumers. These figures bear out the statement that a gas company is probably in closer contact with the public than any other business enterprise.

The "meter readers," read the dials of 9,712,332 gas meters during 1915, an average of about 810,000 "readings" each month; and in each 1,333 readings they made but a single error. Does that not spell efficiency and accuracy?

Thirty-three consumers made complaint of incivility against "index men," but on thorough investigation, none of the complaints proved to be of a serious nature. Orders to the number of 2,208,000 were executed by fitters and other employees during the year, including the installing of ranges, water-heaters, industrial appliances, etc.

The telephone switchboard in the Consolidated Gas Company's Building, Fifteenth street and Irving Place, handled 4,671,266 "calls" during 1915; and between September 13 and October 16 —"moving time"—54,874 telephone "calls" were received asking that gas meters be installed or unlocked. On October 1st and 2d, the gas meter orders totaled 10,594.

The Public Service Commission, First District, during 1915 *tested, at the request of consumers, only 914 of the 885,446 gas meters in use; and of these 914, 504 proved to be operating correctly; 141 were slow, and 268 a trifle fast, and one was not recording at all.*

The company installed 171,960 gas units during the year; 92,331 "C.E-Z" gas lamps, and 3,692 industrial gas units, or a total of 267,983 installations.

Demonstrators, in course of the year, visited 66,200 homes, where they gave free cooking lessons, as well as instructions in the proper use of the gas range.

To manufacture the gas sold, required 1,200,000 tons of coal and about 90,000,000 gallons of oil.

The gas sales of the Consolidated Gas Company fell off 829,075,400 cubic feet during 1915, as compared with 1914; among the reasons assigned for the decrease is the effect of the European War upon large and small manufacturing concerns, which are dependent upon Europe for their raw material, and have in consequence greatly reduced their output.

There was an increase of 90,396 in the number of gas appliances in use in 1915, as compared with 1914, including an increase of 1,582 hotel and restaurant and 3,496 industrial appliances; the Consolidated Gas Company and its affiliated companies has 428,983 cooking appliances out on rental, an increase of 19,920 over 1914.

DIVERTED EFFORTS OF COMMISSIONS.

By Wm. McClellan.

It is with the very greatest regret that many of us who are interested in the establishment of proper relations between public utility companies and the public must confess that, after a seven years' trial, confidence in commission regulation in New York State seems nearly to have departed. Should the Legislature now in session feel inclined to pass new legislation in regard to the commission, as is suggested, there will probably be either a general indifference to what they may do, or pleas from many quarters for more or less drastic action. Probably no group of men realize the seriousness of the situation more earnestly than the public utility operators. These men know that if regulation fails, a worse fate is in store for their business. In the towns and small cities the alternative is, emphatically, municipal ownership. In the larger cities municipal ownership is not so easily taken up as a weapon, but in its place will come local regulation and charters for competing companies.

In casting around for a reason to account for the failure, the kind of men that have been appointed as Commissioners has been given. It has been suggested that engineers ought have been appointed or experienced public utility men, or business men of experience—certainly not so many lawyers. I cannot agree that this has been a serious factor in the matter at all. I have never believed that a Commissioner should be appointed for any technical knowledge or ability that he may have, whether it be business, legal, or engineering. If called upon to appoint a commission, I should expect to look among lawyers, engineers, public utility men, general business men, publicists, and even college professors, in the hope of finding men possessing those other qualifications in addition to technical ability, which are indispensable in good Commissioners. I have a great respect for the ability of an adaptable, intelligent, energetic man to get at the kernel of a techical question, especially when advised by proper technical subordinates.

Now, the fact is there have been a number of intelligent, energetic and honest men on the commissions of New York State. I have been very familliar with the operations of the Second District Commission, and my comments will probably apply more to the history of that commission than to the history of the First District Commission. There have been times when many have not agreed with particular positions taken by the commissions, but I am of the opinion that on the whole no commissioners could have been quite successful in satisfying the public and the corporations under the present public utility laws of this State. I believe that a task has been laid out which no group of men can successfully perform to the satisfaction of all concerned. Recent charges of serious personal derilection by individual commissioners, even if eventually proved, are really incidental. The commissions stood condemned by many persons, on more general counts, before investigation was started.

Both commissions have as their duties: 1. The regulation of issues of securities. 2. Subway construction (First District); grade crossings (Second District). 3. The regulation of rates. 4. The regulation of quality of service.

The order in which I have listed the duties of the commissions above is important, for in it, I believe, is the crux of the whole problem. It may be called the order of necessary attention as the present public utilities law works out in practice. The commissions must grant their permission for every issue of securities, and the provisions of law covering their authority are very definite and controlling. Inasmuch as in most cases proper extension of the business and equipment to a waiting public depends upon the issue of securities, this part of the commission's work cannot be shoved aside. Next in the list, and on the same plane with securities, stands the special construction work of subways and grade crossings. The commissions cannot delay attention to these, and I shall have a word or two to say about them latter. Rates are third, and the business of the company is not interrupted if the rate cases are not pushed rapidly. Moreover, the commissions are not permitted to arrive at rates by any short cut or by commercial considerations as a Board of Directors may, but must pursue a very elaborate method of valuation and fair return, unless, indeed, by grace of the company, a compromise is reached. Last comes quality of service, which must be attended to, but, except when attention is demanded by persistent and insistent local committees, these problems are most easily postponed.

Now, here is the point. While the above order is the order of necessary attention on the part of the commission, under the working out of the law it is exactly the reverse of the order in which the public is interested. There is no question that the public, first of all, expects a Public Service Commission to see that it is getting the maximum amount and highest quality of service possible. A very close second in the public mind, and sometimes even a first, is the question of rates. In a somewhat removed third place comes the question of issues of securities. This latter feature interests the rank and file of the public only when it becomes an obstacle to the lowering of rates.

Now, there is no intention of suggesting that the commissions have purposely avoided rates and service. Rate cases have received their attention, although it is noteworthy that the first important rate case decided by the Second District Commission was not made public until February 4, 1913 — five-and-a-half years after the commissions were instituted. The writer knows that during those five-and-a-half years a tremendous amount of work was done in connection with the regulation of security issues, and in many cases midnight oil was burned. Necessarily, quality of service received attention through a certain amount of systems of inspection, rules for meter testing, and other organization routine. Nevertheless, the enormous amount of time required by capitalization cases positively precluded the taking up of important rate cases which involved, under the conditions of the public service law, as interpreted so far by the commission, extensive study and invertigation. It was unfortunate, however, that but a small amount of time was left for personal, intimate, searching, and extensive study of service conditions in the State. In many cases the commission simply had not time to give adequate consideration to the reports of its subordinates and co-operating societies on service matters, although the investigations had been ordered by the commission. This was not a case of willful inattention or avoidance, but of crowding out by other more peremptory work.

Now, when we come to the extra duties, the construction of subways and grade crossings, a bad matter is made very much worse. I have never been able to find any reason whatever why the construction of subways, involving millions of dollars in contracts, and the technical supervision of an enormous quantity of material and construction, should be placed in the care of a Public Service Commission, which at the same time had huge regulative responsibilities. Such a scheme was foredoomed to failure. The arguments in favor of this, and the reasons which prove it, are so obvious that it is quite unnecessary to cite them here.

So far as grade crossings are concerned, there may be good reasons why this work should be in the care of a commission that is constantly inspecting the railroads of the State. Nevertheless, it has no place in the work of a public utility commission, whose principal function is regulation. The whole matter of grade crossings should be put in the office of the State Engineer, placing upon the public utility commissions the duty of strongly recommending those grade crossings which should be abolished, and depriving the State Engineer of any power to remove a grade crossing until he received a proper recommendation to do so from a public utility commission. That this grade crossing work has been wonderfully well done by the Second District Commission, should not be used as an argument for leaving it where it is. I believe that, to give a regulative commission such definite responsibility for the proper structural design of a grade crossing elimination; for properly harmonizing the often opposed views of municipalities, business men and railroads involved; for proper supervision of the construction work and the expenditure of the money; and for the adjustment of accounts among the municipalities the State and the corporation, causes a dissipation of energy, which results in the deficiency being borne by regulation, the real function of the commission.

The cause of the failure can be summed up by saying that the people expected rates and service to be the big work of the commission, and under the working out of the law the commission has been compelled to devote the larger portion of its time to other things. The people know that Commissioners are receiving $15,000 a year, and the more intelligent part of the public agree that this is not too much pay for the responsibility that must be assumed and for the character of men who ought to assume it. A few of the people who read the reports of the commissions know that the amount spent annually is very large. The amount spent by the First District Commission has no meaning, because of the

enormous amount of engineering and superintendence in subway construction. The approximately $1,300 per working day, excluding Sundays, spent by the Second District Commission has a meaning because practically all its work is regulation. The people of the State have a right to ask what return is coming for this expenditure of $1,300 per day, or upward of $400,000 per year. The people are frankly disappointed. Some may say their expectations were unreasonable, but there they were. When they came to the commission they found it very busy indeed with a great rush of business. As a rule, they eventually got attention and their important problems were settled, but unfortunately their patience was very frequently tried and in some cases tried to the limit. The result of this was to cause a slowly accumulating measure of ill-feeling, amounting in some cases to wrath, but in all cases to loss of confidence that the commission was really working at the problems of the people in connection with public service.

Although the permission to issue securities was occupying by far the largest part of the time of the commission, nevertheless the chief complaint against the commissions on the part of the corporations, has been what they regarded as unwarranted delay in granting permission for the issue of securities. If a group of business men in New York State want to combine several companies, or to make an important enlargement, it is quite unreasonable that they should be compelled to wait three months, six months, or a year, before they can obtain permission to issue those securities which, from the first, they had a legal right to issue. But no one should hastily jump to the conclusion that all the fault has lain entirely with the commissioners. Undoubtedly, cases have come before the commission where the individual commissioners were of the personal opinion that the securities asked for were proper, and, as business men, might have been quite willing to give permission over night. Unfortunately, however, they could not act as business men, but were compelled to act as administrators of a public utilities law. If they were to take a risk in an occasional case and act as business men, it was quite possible they might have to explain in an investigation why they violated some particular provision of the public service commission law. While I have wholesale condemnation for the delay to which business men have been put in their attempts to finance public utility properties in New York State, I believe the root of the evil is not entirely in the methods adopted by the commissioners, but is largely in the public utilities law. It was a mistake, originally, to adopt the microscopical examination of accounts, quite well as this work has been done. It has caused unwarranted and monstrous delays to business men. Even this, however, is gradually becoming a matter of the past, and before long there should be few companies in New York State that have not been thoroughly examined. This should make future delays absolutely inexcusable.

There would seem to be no dodging the conclusion that, if the commissions are to get and retain the confidence of the public, their principal work must be something in which the public is primarily interested; in other words, rates and service. I have noted very definitely that those Commissioners who made somewhat of a specialty of establishing intimate relations with the public were more popular, and I have one Commissioner in mind who made it a point to appear locally as frequently as possible and assist the people and companies in removing all sorts of local friction. I believe his work has been just as important in establishing the value of the commissions as has been the work of those who gave a far larger part of their time to settling great questions of capitalization. Just how a more pleasing condition is to be brought about raises some very large questions which cannot be answered offhand. In Pennsylvania, and some other States, the commissions have practically nothing to do with the regulation of the issues of securities. Many publicists condemn this, asserting that if securities are not properly regulated, it will be practically impossible to regulate rates later.

It is noteworthy that the Massachusetts Commission has managed to perform a service of regulation which seems to be satisfactory, has retained the confidence of the public, and has cost a very small amount or money. While some persons think the commissions might have administered the preseut law much less meticulously, a larger number believe that if the present public service commissions law is to be rigorously administered, there is no possibility of reducing the number of Commissioners, their salaries, or the other expenses. Undoubtedly, if it were advisable to limit the application of the public service commissions law to the regulation of rates and service, one commission of not more than five men ought to be able to satisfy all the conditions, and the total expense for maintaining such a commission should be immensely less. Apparently the necessity for the regulation of issues of securities seems to be settled in the minds of many publicits. I do not believe, however, that the subject has ever been sufficiently argued. It is noteworthy that the Hadley Commission on Railroads recommended that the regulation of security issues should not be added to the duties of the Interstate Commerce Commission. I am quite convinced, however, that even if it should be decided that it is necessary to regulate security issues, either for the protection of the public in the matter of rates or for the protection of the investor, it would be very much better either to eliminate it entirely from the work of the public service commissions, or else arrange the law so that this regulation could be done on the basis of business judgment with a minimum of accounting and engineering examination. There has been a great deal of patience on the part of citizens and corporations with the experiment in New York State in public utility regulation. The unfortunate outcome has not been due materially to the character of the men that have been appointed, but to the task which has been set before them. If success is to be attained in the future, I believe it will be necessary, first, to redraw the law very carefully in the light of experience with the present law, removing all construction work from the commission, and either transferring completely, or minimizing to a great degree, the time which the commission is required to give to security issues, so as to permit the maximum of supervising attention to rates and service.—*New York Times.*

Drugs from Coal Tar.

In a recent address to the French Société d'Encouragement pour l'Industrie Nationale, M. Fourneau pointed out that for mineral drugs France is largely independent of Germany. Preparations of iodine, bismuth, mercury, arsenic, glycerophosphoric acid and lithium are distinctively French; but in bromine, potassium and masnesium, the Germans have an advantage. In the drugs derived from coal tar, the French producers had allowed their opportunities to slip, by waiting to see whether this or that novelty would prove a success. At the time the war began they had, however, largely made this up, and practically everything was made in France except sulphonal and its derivatives, and phenacetine. Great efforts have been made to fill up the gaps, and now it may be said that France is in a position to make almost all these drugs.

The following table shows the derivation of the principal pharmaceutical products of coal tar:

1. Benzol			Salol
		Salicylic acid	Salicylates
			Methyl Salicylate
	Phenol		Aspirin
		Paranitrophenol	Phenacetine
		Orthonitrophenol	Guiacol, Thiocol
		Oxyphenyl-arsenic acid	606
		Chlorophenol	Guiacol
	Diphenols	Resorcine	
		Pyrocatechine	Adrenaline
			Guiacol
	Chloronitro-benzene		
	Aniline	Phenylhydrazine	Antipyrin
			Pyramidon
		Piperazine	
		Acetanilide, Exalgin	
		Atoxyle	606 or arseno benzol
			Hectine
		Diethylaniline	Novocaine
		Dimethylaniline	Stovaine, Alypine
2. Toluene	Benzoic acid	Eucaine, Stovaine	
		Phthaleine	
		Amidobenzoic acid	Novocaine
			Orthoform
		Benzonaphthol	
		Cryogenine	
	Benzaldehyde	Cinnamic acid	
3. Naphthalene	Benzonaphthol		
	Naphthol		
	Betol		

Telephone • John, 2996.

THE AMERICAN GAS LIGHT JOURNAL

Cable, • Am-Gas.

Entered at the Post Office, New York City, as Second-Class Matter.

Published Weekly at 42 Pine Street, New York City.

SANFORD K. CAMPBELL, Editor.

E. P. CALLENDER, Pres. and Treas.
F. A. SOUTHWORTH, Vice-Pres.

CHARLES H. WADELTON, Secretary and Manager.

NEW YORK, MONDAY, FEBRUARY 21, 1916.

FORTY-SIXTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

BOSTON, MASS., Feb. 16, 1916.

The 46th annual meeting of the N. E. A. G. E. convened at 10 A.M. at Young's Hotel. The room was crowded when President Morrison declared the meeting open. Weather very cold but bright and sunny. The usual routine, as outlined in the programme, was carried through, the reports showing the Association in excellent shape.

One of the recommendations made by President Morrison, in his address, was for a change of meeting place, but it is very much doubted if this will ever be done, since the same suggestion has been made before, and because Young's has been the scene of the meeting for so many years, the conservative spirit of New England will in the end prevail, and the 146th annual meeting will likely be held here.

The first paper read was "Burning and Distilling Water Gas Tar," by Chas. Otten, Jr. The paper was very interesting and brought out a splendid discussion, participated in by Messrs. Nute, Clark, Scott, Wyant, Norcross, Kneeland, Dr. Wing, Addicks (W.R.), Abbott and Polk.

Nearly all the speakers had had experience in burning tar under boilers, etc., and the discussion finally wound up with a short description by Dr. Wing of the making of picric acid for war munition from benzol and toluene.

Mr. C. A. Learned, Chairman of Committee on President's Address, made a report endorsing President Morrison's recommendations, and urged they be adopted and put into effect.

Wednesday afternoon's session opened at 2:30, with reading of the paper on "Residence Burner Maintenance," by W. A. Parkhurst.

Secretary Gifford called attention to the importance of this paper, and its question whether maintenance should be done by the gas company or some one else. Mr. Buckminster told of experiences in Fall River. Burr, of New Haven, said his company had maintenance for which a charge of 10c. was made, while the average cost was 8 $\frac{5}{16}$ cents per lamp, and last year took care of 4,100 lamps.

Mr. Crafts said Pittsfield has maintenance, for a charge he did not name, at a cost last yesr of 4$\frac{1}{2}$ cts. per call — which he explained was due to the fact that during the year 1914 every burner was put in order, and did not require much attention in 1915.

Mr. Conroy read letter from R. C. Bishop of Christ Church, N. Z. (see article in JOURNAL of Jan. 3, p. 10).

President Morrison believes in free maintenance heartily.

Carl Graf, Albany, N. Y., does not believe that maintenance should be done by an outside contractor, but by the gas company, as the contractor cannot be so well controlled.

Mr. Barnes of Cambridge, speaking on the subject of requests for maintenance, said his company sent out 2,000 circulars with return cards, and received but 60 replies.

Mr. Smart and Mr. Hays agreed that something must be done to hold the lighting business, regardless of cost to the companies, or the consumption per consumer.

Mr. Sidney Mason said that judging from the business done by his company last year, there is no evidence that gas lighting is on the wane, as 1915 was the biggest year the Welsbach company ever had. Messrs. Norcross and Barnes spoke of evidences that gas lighting was not decreasing.

Mr. Wood said that some time ago an article appeared in a trade journal to the effect that the real reason for the falling off in gas sales was inefficient salesmen, and that gas companies should go to the electric industry for solicitors.

President Morrison asked W. R. Addicks to reply, and he said he would answer by asking this question:

How many electric men have succesfully managed gas companies, and how many gas men have successfuly managed electric companies?

The next paper was "Intensified Selling as Applied to Gas Water Heaters," by A. A. Higgins.

Mr. Burr of New Haven told of a campaign that sold 600 heaters, and Mr. Drake of Lynn of one that sold 550.

The nominating committee recommended:

For President, H. C. Crafts.
First Vice-President, Dr. J. F. Wing.
Second Vice-Bresident, J. A. Norcross.
Directors, Burton Smart and R. E. Slade.

Their report was adopted and the ticket unanimously elected.

A very pleasing feature was the action of the Association in electing Mr. E. C. Jones, now of San Francisco, but formerly of East Boston, to honorary membership. The many friends of Mr. Jones, the JOURNAL, of course, included, rejoice in the honor done him.

THURSDAY MORNING SESSION.

First paper was that by C. D. Jenkins, on "Gas Meters," and the excellence of its contents and presentation called out a good discussion. Those who participated were:

Messrs. Gifford, Crafts, Price, Otten, Gould, Nute, Norcross, Barnum, Kennedy, Africa, Hintze, Smart and Lindsay.

The paper by A. S. Hall, on "High Pressure System and Welding of Mains at Springfield, Mass.," was good descriptive matter, and as welding is not common in New England, it was of great interest. Although many questions were asked, it could not be very well discussed as only two of the companies represented have had any experience. Mr. Smith of Weymouth, and Strong of Brockton, gave their experience, and J. B. Redd, formerly of Pacific Gas and Electric Co., San Francisco, and now with the Davis-Bournonville Co., told of Coast experiences, and of the welding of 75 miles of pipes in sizes from 2 to 16". Messrs. Crafts, Lindsay, Schawbe, Otten, Tedbury and Nixon asked questions about the process.

Mr. Barnum offered a motion approving affiliation with the Institute, and after an explanation by Mr. Klumpp, representing the Institute, of the many benefits to be derived, it was decided to affiliate.

On motion by Mr. Barnes, it was voted that the retiring president, year after year, be the Association representative.

Time was growing short when the last paper was read, on "Aligning and Releveling 200,000 cubic foot Holder at New London," by A. R. Schiller. This was a good descriptive account of a clever piece of engineering, and was listened to with great interest.

Death of B. W. Perkins.

Benjamin Wilton Perkins, first President of the American Gas Institute, died February 11th, at his home in Hartford, Conn. Mr. Perkins came to this country from England, when 9 years old. His first connection with the gas industry was under his father, at South Bend, Ind., where he eventually became manager; then he served at Altoona, Pa., for 10 years, and in 1910 was made manager of the Hartford City Gas Light Company. He was a member of the National Commercial Gas Association, the Michigan Gas Association, the Society of Gas Lighting, the New England Society of Gas Engineers, and the American Gas Institute.

I. E. S. Tenth Anniversary, Mid-Winter Convention.

The celebration of the tenth anniversary of the founding of the Illuminating Engineering Society, took the form of a Mid-Winter Convention, held February 10 and 11 at the Engineering Societies Building, New York City. The distinguishing feature of the meeting was the presentation of Honorary Membership to Mr. Thomas A. Edison, and the reflected glory incident to its acceptance.

The first session, on Thursday morning, presided over by that diplomat of the public utility field, Mr. Arthur Williams, received a welcome from the Hon. John Purroy Mitchell, mayor of the largest city in the world. He spoke most highly of the importance and value of the engineer in civic matters, and stated that the expense of public lighting in New York had been reduced by $500,000 in the past two years, and the light increased 100%. In the response Dr. A. E. Kennely endeavored to further the thought that the aim of the Society included Art as well as Economics. After ten years this is still an aim, not a realization.

The President, Mr. Charles P. Steinmetz, "The Great Expounder," in his address gave a wonderful comprehensive outline of Illuminating engineering. He said that the installation of a lighting equipment was physical, its work physiological, but the results were judged by the psychological effect produced. The part that light plays in the world's activities was shown by a short description of its applications in physics, applied physics, physiology, psychology, architecture, decoration, ophthalmology, hygiene, sanitation, bacteriology and therapathy.

The next speaker, Mr. L. S. Marks, first President of the Society, gave a resumè of the work accomplished, and, fortunately, kept away from figures. What to avoid is something well practiced by Mr. Marks. Expectancy was in the air as Prof. Münsterberg, of Harvard, who has been keeping the Jingeos on edge of late, arose to speak on "Psychology and Light." He made a plea for psychology as an asset to the business world, admitting its limitations, but showing that it had examined its own shortcomings. For industrial work no exact data is available, but experiments are now underway to show a workman's ability under lights of different colors and intensities. In street lighting, non-uniformity requires greater mental activity, attention, etc. In interiors, he says, "how much shadows help toward an easy grasp and organization of the surroundings, and through them, to the comfort of the mind."

Architecture was the next subject brought up, and Mr. Charles R. Lamb represented his profession quite as well as any who appeared in the symposium, which the addresses turned out to be.

The final address was by Dr. F. Park Lewis, whose work in Sunlight Cures for tuberculosis has given him a niche in the Hall of Fame. He spoke of the "Action of Light on Living Organisms," and said that sunlight will cure anything; which we can easily subscribe to, provided it is handled by Dr. Lewis.

During the noon recess, the visiting ladies and some of the men attended an informal luncheon at the Hotel Biltmore, after which skating was enjoyed in the ice rink.

Thursday Afternoon Session.

The first paper of the afternoon session, "Possibilities of Stage Lighting," read by the author, Basset Jones, covered some of the work accomplished by him in a number of productions.

The "Relation of Lighting to Architectural Interiors," by Prof. Morgan Brooks, which was read by A. L. Powell, contained many strictures against the extremists in all three of the notable divisions of lighting. His criticisms, curiously, were in accord with those mentioned by Prof. Münsterberg. "The successful attempt to introduce light from nowhere has outdone itself, as the logical mind is baffled by the absence of a source of light." "Completely diffused light is wearisome, as evidenced in "White Kitchen" Restaurants. "Bracket lighting produces objectionable cross-lighting and glare." In the discussion by Messrs. Cravath, Doane and Macbeth, the main points wore agreed upon, although it was shown that the last objection could be overcome by proper shading.

The final contribution, covering a new method of computing light flux and horizantal illumination, by W. A. Hodge and R. W. Chadbourne, was read by the former. The simple graphic method described should be of assistance to those not provided wiih illumination slide rules.

Among the gas men in evidence at this sessions were Messrs. T. M. Ambler, H. C. Palmer, E. Korthaus, Louis Stotz and Charles Hodgson.

The Banquet.

The Grand Ballroom of the Hotel Biltmore was the scene of the next "Session," as the banquet proved. Promptly at 8:30, one hour after schedule, the feasting and meriment proceeded, and were followed by a short address by President Steinmetz. Then came the oration of the evening, Mr. John W. Lieb making the presentation speech, which very properly began with reminisences of Noah, and ended after homage had been paid to all others who had been interested in Arc or other lights, right down to Edison Day, October 21, 1879, which the General Electric Company would have us celebrate every year. Then followed a response for Mr. Edison by Mr. W. H. Meadowcraft, and an address by Mr. T. C. Martin. The closing exercises consisted of professional entertainment, arranged especially for the ladies, a large number being included in the 400 diners.

The "New York Times," the following day, stated that Mr. Edison was honored by Electricians, but the following gas men were in attendance: W. R. Addicks, A. C. M. Azoy, Will W. Barnes, F. R. Barnitz, W. S. Barstow, C. O. Bond, W. H. Bradley, H. M. Brundage, A. H. Elliot, O. H. Fogg, A. H. Hall, W. G. Hoyt, H. E. Ives, E. G. Love, H. B. McLean, W. C. Morris, J. A. Norcross, H. T. Owens, G. F. Parkhurst, W. C. Phelps, H. B. Reinach, T. S. Scofield, W. J. Serrill, W. S. Stark, C. W. Wardell, G. H. Woodall, G. E. Woods, E. S. Young and P. S. Young.

Friday Morning Session.

The first paper this morning was that by Thomas Scofield and C. L. Law, on the "Lighting of the General Offices of the Consolidated Gas and the New York Edison Companies, Consolidated Gas Building, New York City." It was read by Mr. Scofield; gave results of tests of the illumination in the gas lighted and electric lighted portions of the building, and was illustrated by views of individual officers, details of the fixtures, etc. Semi-indirect fixtures are used throughout, and a good part of the discussion was upon the adaptability of such lighting to drafting-rooms and other special purposes. The new building in Baltimore, for the Consolidated Gas Electric Light and Power Co., will be treated in several different ways. The office rooms will be equipped all alike, and other floors according to the uses to which they will be put, and in keeping with their architectural detail.

At 11 o'clock President Steinmetz yielded the chair to Mr. Stickney, and James D. Lee, Jr., read his paper, "Gas Lighting in a Cathedral," describing and illustrating the semi-indirect installation in the Cathedral of SS. Peter and Paul, in Philadelphia. (See JOURNAL of Dec. 20, 1915, page 395.)

The discussion brought out that this displacing of electric lighting was due to improved system presented, not a competition between gas lighting and electric lighting per se. Mr. R. ff. Pierce described it as showing the value of engineering in illuminating problems. J. E. Bullard considered it a competition between two services, in which gas won, although good engineering service is generally better pushed by the electrical interests; if gas men will devote more engineering study to their problems, there will be more gas papers at I. E. S. Conventions. Mr. Cravath saw proof of the value of the Association's work. Mr. Isreal, of the Philadelphia Electric Co. said the change to gas lighting was due to the difference of treatment of the problem. The last paper of this session was that by A. C. Robinson, on "Candle Power Measurements of Series Gas Filled Incandescent Lamps," giving photometric curves and data of gas filled tungston lamps of different filament mountings.

There were four papers left for the afternoon session, beginning at 2.00 o'clock.

1. "An 'Average Eye' for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality-of-Brightness Photometer," by E. C. Crittenden and F. K. Richtmyer.

2. "An Inter-laboratory Photometric Comparison of Glass Screens and of Tungsten Lamps, Involving Color Differences," by Dr. G. W. Middlekauff and Dr. J. F. Skogland.

3 "An Integrating Photometric Sphere, its Construction and Use," by Dr. E. B. Rosa and Dr. A. H. Taylor; being a description of a 90" structural steel and re-enforced concrete integrating sphere at the Bureau of Standards, with results of tests with it.

4. "A Box Photometer," by Dr. I. O. Grondahl; dealing with the subject of integration photometry, and describing a small box photometer recently constructed by the author.

At the evening session in the Auditorium, Engineering Socities Building, W. D'Arcy Ryan gave his address on "Lighting of the Panama-Pacific Exposition," illustrated with large colored transparencies. This was the first opportunity in the East to hear about these wonderful lighting effects from the author himself, and was thoroughly appreciated by the audience.

Possibilities of House Heating by Gas.

Paper by W. H. BRADLEY, read at the Tenney Service Convention.

The rapid development in the use of artificial gas for industrial purposes is leading up to the possibilities of the heating of detached dwellings with it, and it is no more of a stretch of our imagination at this time to contemplate this, than it was 30 years ago to picture the displacement of coal, wood and oil and the common use of gas appliances as we know them to-day.

If artificial gas can successfully displace other fuels for cooking, water heating and various industrial purposes, why cannot its use for house heating become general?

The tendency of gas rates is always downward. As improved methods of production appear and cost of operation is reduced, the customer gets the benefit of a lower rate; so it is safe to believe that whatever the rate in a city is to-day, a few years hence it is likely to be lower. On the other hand we know that the supply of coals in the ground is constantly decreasing and that when a ton is mined there is no way of producing another ton in the same place; also, the supply each day is becoming more expensive to mine, and there is no doubt that coals desirable for domestic use will be more and more costly as time goes on.

The heating of our dwellings as now done is an economic waste, due to the fact that there is not proper regulation of the fuel, and that our present method of burning solid fuels in air is crude.

Because of the foregoing, some method of heating dwellings from a central plant, due to economies that can be maintained there, may be thought of. We have at our command the modern gas plant, worked out commercially to a success both as to mechanical details and methods of successfully handling the by-products; and the future has in store the possibility of developing this equipment into a central fuel plant. In order to make this possible some pioneer development of a steam heating or hot air heating system that can be dependable and intermittently controlled and to work at a relatively high rate of efficiency, will have to be accomplished.

Experiments in the house heating field have been conducted by some gas companies, notably the Laclede Gas Light Company, of St. Louis, Mo., who with the common Bunsen burner applied to certain specially constructed equipment of their own, found the cost of operation with gas at 80c. per thousand for the first 10,000 cubic feet and all excess at 50c. per thousand cubic feet, approximated twice that of anthracite coal at $8 per ton. Other companies that have experimented along the same lines have not met with any better, if as great success, as the above. In New England we could not hope to do nearly as well, using the same equipment, as our winter temperature averages from 15° to 20° lower than in St. Louis.

It is the writer's belief that, with the practical development of the surface combustion burner intermittently operated, in connection with a special designed boiler and control, the time is at hand when it is reasonable to consider the general use of artificial gas for house heating purposes.

The advantages claimed for the surface combustion system are:

"(1) The combustion is greatly accelerated by the incandescent surface, and if so desired, may be concentrated just where the heat is required;

"(2) The combustion is perfect with a minimum excess of air;

"(3) The attainment of very high temperatures is possible without the aid of elaborate heat recuperative and regenerative devices;

"(4) Owing to the large amount of radiant energy developed, transmission of heat from the seat of combustion to the object to be heated is very rapid. These advantages are so uniquely combined in the new system that the resultant heating effect is for many important purposes not only pre-eminently economical but also easy of control."

From the writer's point of view the above claims seem to be borne out by the results obtained in the application of the system to hotel appliances, recently made in Springfield.

In order to use the Surface Combustion System successfully for house heating, a special type of boiler and control will have to be developed. At a recent date certain experiments were made at our plant, on a vertical tubular boiler of special design. It developed that this boiler was over large, and had too much heat absorbing surface for the space left for burners; it also had an opening which permitted excess air to be introduced into the combustion space, which effected the efficiency, and it followed that the results obtained, while enlightening to a degree, were not such as would have appeared had the heat surface been proportionate to the size of the burner used, and the opening in the fire box been closed. The data obtained from this test was as follows:

It was estimated that the boiler contained one hundred fifty (150) gallons of water, approximately 1,300 pounds; that it took 700 cubic feet of gas to bring this volume of water to the boiling point in one hour and forty-five minutes; that in two hours thereafter there were evaporated 215 pounds of water, using 500 cubic feet of gas. With gas at 600 B. T. U. per cubic feet, the efficiency was approximately 70% i.e. 70% of the total B. T. U. was absorbed in converting the water into steam.

With this crude apparatus, and using a special rate of 60c. for gas, the cost would be $1.40 to evaporate 1,000 pounds of water, and with coal at $8.00 per ton, assuming that a house heating boiler would maintain an hourly evaporation of six pounds of water per pound of coal, it would cost 67c. to evaporate 1,000 pounds of water. The above shows, even with the apparatus used, the cost for gas was but slightly more than twice that of coal. It is not believed, however, that the above assumption for coal is, or can be, maintained as there are times when the demand for steam is much below the boiler rating; therefore, it seems reasonable to believe that with an intermittently operated surface combustion burner, in a boiler specially designed and adapted for it, i.e. having the proper quantity of heat absorbing surface, and the rate of evaporation per square foot of surface so high that the boiler is relatively small, with corresponding small radiation losses, the possibilities of heating dwellings from a central plant with gas, is at hand.

In the middle west where natural gas is available, the heating of houses by it is almost universal. True, the rate for natural gas is about 30 cents per thousand, but it must be remembered the coal used there sells at about $4.50 per ton. We could hardly hope to displace $4.50 coal with artificial gas at our rates, but we can displace to a certain extent, $8.50 coal. There are about 80% more B. T. U's in natural gas than in artificial gas, and that is where the real difference appears.

However, we most not expect to get into the house heating business with our product by claiming it to be as cheap as coal, that is, just yet. The time undoubtedly will come when we can, but for the present, if the cost is 50%, or even 100% more, hundreds of installations can be made in homes of people who are willing to pay for the convenience, cleanliness and positive control which goes with house-heating by gas.

Pumping California Crude Oil.

The crude petroleum produced in California is a dark, thick, viscous liquid, with a strong odor of sulphur. Most of the present-day production is between 14° and 28° B., 0.9722 to 0.8861 specific gravity. The wells from which it is produced vary in depth from 200 to 4,000 feet; the lighter oils usually found in the deeper wells. In the Kern River field, one of the first inland fields to be extensively developed, the producing sands are seldom at a depth greater than 1,300 feet. Probably 80% of the oil in this field is heavier than 15° B., and the difficulty in moving this viscous material through pipe lines, especially in cold weather, has developed a unique process of pumping known, locally, as the "Rifled System," successfully used for 8 years by the Associated Pipe Line Co., for transporting oil 280 miles to Port Costa, on San Francisco Bay. The system consists in pumping cold oil of from 13° to 15° B., together with about 10% of water, through an 8" pipe corrugated spirally, or "rifled." The rifles are put into the pipe as it made, the indentations being pushed into the pipe from the outside. The rifles make one complete revolution in 10 feet of length of pipe, and give the interior much the same appearance as a gun barrel. In operation, water is forced into the pipe around its periphery, through an injection nozzle surrounding the pump discharge and about 10 feet from the pump. Since the pipe is already filled with oil, the water injected forms a film between the core of oil and the walls of the pipe. As the mass moves forward the "rifles" give to it a whirling motion, and because of the greater specific gravity of the water, centrifugal force holds the film of water in place, keeping the oil from contact with the pipe, and greatly reducing the frictional resistance.

Experience, however, has shown that the rifled-line pumping is limited to oils not lighter than 15° B., as oils of ligther gravity form an emulsion with the water, and produce a mixture that is difficult to pump and hard to separate again.

An Analysis of Oil-Gas Tar.

By H. E. BRUNKOW, in "Journal of Electricity, Power and Gas."

The recent sudden demand for benzene and other light oils found in coal tar, has led men everywhere to develop old sources of supply and to seek new ones. One of the most likely products to look to seems to be oil-gas tar. The writer having made a series of practical analyses of this tar, endeavors to set forth the methods used and results obtained, and hopes that contemporary experimenters may profit by this knowledge.

The tar used was the by-product of a gas averaging 570 B. T. U. and therefore generated at a higher temperature than is ordinarily used, made from a California crude with a gravity of about 18.8° B. The tar was pumped from the separator through a series of screens, to a settling tank, and from there to a storage tank from which the test samples were taken. The specific gravity of the tar at 95° F. was 1.026.

The first process of a logical investigation of a tar is distillation with condensation of the fractions. But in this product a difficulty was encountered, in that the tar would not distill without frothing or bubbling over. Also naphthalene clogged the condenser tube after heating a short time.

To overcome the latter difficulty, picric acid was introduced into the still with the tar, to precipitate the naphthalene; but the frothing over still continued, in spite of the fact that the greatest precautions were used in heating. In one instance the temperature in the electrically heated still was raised only a few degrees each hour over a period of several days. These facts led to the conclusions that: (1) the tar contained an extraordinary amount of water; (2) the naphthalene deposited because of the absence of solvent light oils.

Several other methods were tried to determine the quantity of water. One of these, the calcium carbide method (Proceedings, Pacific Coast Gas Association, vol, 8, pp. 458), gave satisfactory results, but necessitated an elaborate apparatus. Another method was distillation under a vacuum of 17" mercury. This was successful, in that it eliminated to a great extent the condensation of naphthalene in the condenser tube, and also required only low temperatures. Still another method was to place a sample in a drying oven for twenty-four hours at 212° F. This was not tried until it was certain that no large quantity of light oils was present.

The next step was to determine the soluble oils and lampblack. For this an ordinary Soxhlet extraction apparatus was used, with carbon-disulphide as the extracting liquid. After the process was completed, the tarred extraction thimble with the lampblack was dried and weighed, as was also the flask containing the oils.

The naphthalene was determined by placing a sample of tar in a silica boat, and putting this in a glass tube connected directly to a Drechsel's gas washing bottle, with another bottle in series, both containing standardized picric acid solution. The last bottle was connected to a filter pump and air drawn through, which, passing over the tar sample carried the gas naphthalene with it. The tube was gradually heated so that all the naphthalene was expelled from the tar.

The results obtained were as follows:

Sample.	Water.	Method.	Lamp-black.	Heavy Oils.	Naphtha-lene.
(1).....	64.4%	Cal. Carbide	.....	.....	.....
(2).....	65.6%	" "	.....	.....	.....
(3).....	60.0%	Distillation	8.6%	25.1%	.....
(4).....	60.9%	"	.....	.....	.....
(5).....	60.7%	Evaporation	10.8%	27.1%	.....
(6).....	.....	.....	.....	.....	4.5%

In the distillation, a small quantity of naphthalene came over with the water, as did also a little light oil—less than .2%—the nature of which was not determined. The lampblack contained a small amount of salt which was also disregarded. The heavy oil, after drying at 212° F. and cooling, became hard, and was assumed to be asphaltum.

Averaging the above percentages we have:

Water	62.3%
Lampblack	9.7%
Asphaltum	26.1%
Naphthalene	4.5%
Total	101.9%

The conclusions derived from these results are as follows:

(1) The bulk of the water is held in an emulsion. The lampblack, which is throughout in the tar, is also saturated with water. Both these conditions are causes for frothing, and so, under no ordinary conditions can this product be successfully distilled.

(2) The tar is saturated with naphthalene, as is evidenced when a sample is kept in a container. After a short time crystals deposit on the sides with the slightest cooling.

(3) The only reason the tar can be successfully pumped is because it contains a high percentage of water. This is also a reason why it can be readily burned under a boiler, the water making it easy for the steam to atomize the emulsion.

(4) The tar is worthless for the recovery of valuable light oils.

Seasonable Displays.

By W. D. STODDARD.

The recent cold snap in Louisiana, which came so suddenly that it caught lots of people unawares, was used by a New Orleans appliance dealer to preach a little lesson on "Preparedness." He did it by two window groups that brought out his point better than words, and which would be equally effective in any part of the country where steam heat is not in general use. All through the south and southwest, on account of the mild climate, people are prone to neglect proper precautions for heating their homes and offices, and here is where the dealer made his play.

The window was divided into two sections. In one, huddled up at her desk, trying to operate her typewriter, was a girl in jacket and furs, with a rug wrapped about her knees. A drooping and dejected palm was seen in the background, and a rusty oil stove occupied the center, while a card bore the single word, "Freezing." The other section of the window showed a girl busily clicking away at the typewriter, unencumbered by wraps, and wearing one of the lacey lingerie blouses affected by women. A fresh and vigorous palm waved in the background. In the center of this section was a bright and shining gas heater, and a card here said: "Working in comfort."

By the heater was a neat sign:

"There Will Never be a Better Time than Right Now.
Be Prepared for Old Jack Frost"

Overhead there swung a large sign that said:

"SPECIAL SALE OF GAS HEATERS.
Heat where you want it, When you want it. As much as you want.
Removes Worry, Dirt and Ashes."

Not only for cold weather, but all the year around gas is an advantage, and this was pointed out in another window—likewise in a practical way—by actual demonstration. A section of a kitchen was shown. It was just an average kitchen, with various utensils hanging on the wall, and a wooden table holding a kerosene lamp. A woman in neat dress and big kitchen apron is seen putting coal into a cold and rusty stove, with the evident intention of heating a pail of water, which stands near by. A big cardboard sign bears the picture of a duck with a winking eye, who is supposed to be saying: "He calls her his angel—but who ever heard of an angel carrying coal?"

At the other side was a gas hot water heater, and a gas jet for lighting. A large red arrow points to these and says:

"Eventually he will connect his home with the gas main
and install this heater, furnishing a bountiful
supply of hot water in a few minutes.
NO DUST, DIRT NOR ASHES."

Their pertinent little ads. in the newspapers also brought them many customers, as they went straight to the point, without any unnecessary verbiage. In clear black type, with ample white space surrounding, they caught the eye of everyone who picked up a paper. Here are a couple of them:

"WAS IT CHILLY IN YOUR BED-ROOM THIS MORNING?
Of course it was—you could hardly dress.
Don't do it again—you'll catch cold.
Order one of our GAS HEATERS, light it, and in a few minutes
the room is warm and you can dress in comfort."

"DON'T SIT AND SHIVER IN A COLD ROOM.
Have you ordered a gas heater for your room?
If not, do it NOW.
Be warm and cozy these chilly evenings."

Accident Prevention in the Chemical Industries.

The accidents directly related to the manufacture of chemicals are largely occupational diseases, or burns from acids or poison by some mineral. Especially dangerous minerals are lead, arsenic, mercury and phosphorus. In addition we have the danger of acids which corrode the skin and act as caustic, and in the form of vapor attack the teeth. Wood alcohol produces blindness if taken internally, or if breathed in large quantities; and gases such as carbon monoxide, methane or marsh gas are deadly. In fact, all of the hydrocarbons are more or less poisonous. One of the ever-present dangers is that if there is any abrading of the skin or any skin disease, such as may arise from certain products such as varnish, other diseases are easily engrafted on it. The principal thing is cleanliness of the hands, so wash basins are necessary, and many times gloves. Some of the anilines are also poisonous. There is danger of explosion in many lines, the principal means of prevention are dust hoods, washing, etc.

The list of industrial poisons is a long one, and since they attack from so many points, they must be studied closely. Here are some entitled to special attention: Acetaldehyde, ethyladehyde, acridine, acrolein, ammonia, amylacetate, amylalcohol, aniline, aniline dyestuffs, antimony compounds, arsenic compounds, arseniureted hydrogen, benzine, benzol, carbon dioxide, carbon disulphide, carbon monoxide, chloride of lime, chlorine, chlorodinitro-benzol, chloronitrobenzol, chromium compounds, cyanogen compounds, diazomethane, dimethyl sulphate, dinitrobenzol or binitrobenzol, formaldehyde, hydrochloric acid, hydrofluoric acid, lead, manganese dioxide, mercury, methyl alcohol, methyl bromide nitraniline, nitrobenzol, nitroglycerin, nitro-naphthalene, nitrous gases, oxalic acid, petroleum, phenol, phenylhydrazine, phosgene, phosphorous, phosphorous sesquisulphide, phosphureted hydrogen, picric acid, pyridine, sulphur chloride, sulphur dioxide, sulphureted hydrogen, sulphuric acid, tar, turpentine oil.

Since these may attack through the respiratory organs, by absorption through the uninjured skin, and through the digestive organs, specific measures for the protection of workers must be devised.

Beside these risks, are those inherent in the processes of manufacture of the so-called heavy chemicals, sulphuric, nitric, muriatic, hydrofluoric acids and their by-products, sulphate of alumina and other alkaline products. There is a certain risk from fumes in the manufacture of acids, but this is very remote, the most dangerous fumes being those produced in the manufacture of nitric acid, which are released only through the breaking down of some portion of the apparatus. The most dangerous of the acid burns are hydrofluoric, nitric and sulphuric.

To protect the eyes of men working with these acids where there is danger of splash, they should be obliged to wear rubber-lined goggles, fitting close to the face. All bad results from getting the acid on the person can be avoided by thorough washing with plain water, which dilutes and removes the chemical from the skin.

Men working on acid pipe lines should be furnished with a rubberized cloth hood with mica covered eye openings, to guard against a sudden squirt of acid which might strike them in the face. In working in alkaline processes, men should wear rubber gloves.

—W. Keough in "American Industries."

Nitre-Cake Instead of Sulphuric Acid.

The English Ministry of Munitions has issued a circular stating that, owing to the demand for sulphuric acid for explosives, that department considers it advisable that steps should be taken to substitute nitre-cake for sulphuric acid in the production of ammonium sulphate, the recovery of grease from suds, dyeing, etc. Nitre-cake is a waste product from the manufacture of nitric acid, consisting substantially of acid sodium sulphate, and it is produced in large quantities in the numerous nitric acid plants lately erected. Information on the use of nitre-cake and the places where it can be obtained may be had on application to the Explosives Department of the Ministry.

The use of nitre-cake instead of sulphuric acid in various processes in the woolen trade will be considered at once, as the Explosives Department will require, for immediate use, all the sulphuric acid now available.

Sulphur in Coke.

[From paper by J. R. Campbell, to American Institute of Mining Engineers.]

Sulphur exists in coal as sulphides and sulphates, as can be determined experimentally, and there is also so-called organic sulphur, or sulphur in combination with the carbon, hydrogen and oxygen of the coal, about which nothing has been definitely proved.

In most coking coals it can be safely assumed that the preponderance of sulphur is in the form of pyrite (FeS_2); which when exposed to comparatively low temperature during the coking process, loses its sulphur according to the reaction, $7\,FeS_2 = Fe_7S_8 + 6S$. Six out of the 14 atoms of sulphur (of 42.8%) are volatilized. Fe_7S_8 remains in the coke as pyrrhotite, or magnetic sulphide of iron, which accounts for the magnetic properties of the powdered coke. A more commonly accepted reaction is $FeS_2 = FeS + S$ in which straight sulphide of iron is produced with 50% volitilization of sulphur.

In the beehive methods of coke making, sufficient air is introduced to carry on the distilling and coking processes, and the sulphur is oxidized, first into sulphur dioxide (SO_2), known by the pungent and suffocating odor emitted from the trunnel head; second, into sulphuric anhydride (SO_3); and, finally into sulphuric acid, when it comes into contact with air and moisture. In a properly regulated draft on a beehive oven, there is never complete combustion of the gasses; the coking process should be carried on in a reducing atmosphere, and a low grade producer gas kept issuing from the trunnel head. For coals of about 30% volatile matter, the ratio of air to gas is $3\frac{1}{2}$ to 1, in complete combustion, the ratio is 6 to 1, producing a temperature in the crown of the oven of 3500° F., more than enough to fuse the refractories used. A good coking temperature is 2500° C. in the crown of the oven.

It follows then that the sulphur remaining in the coking mass as iron sulphide, cannot be affected by the aeration or draft on the oven. Among beehive coke-oven operators there used to be a saying, "the hotter the oven, the more sulphur burned out," but this probably never was true unless the aeration was carried to complete combustion of the volatile gases and the fixed carbon itself, in which case the iron sulphide (FeS) would, of course, be oxidized to Fe_2O_3, and the sulphur liberated, as usual. This condition would not be productive of good results, as the coke yield would be abormally low and the "ashes," or "braize," correspondingly high. This is evidence that, so far as the pyritic sulphur is concerned, any sulphur volatile at all, is so volatile at comparatively low temperatures, and no practical method of superaeration will help in its further elimination.

On the other hand, overheating promotes chemical reactions in which sulphur forms compounds with other bodies on which heat has no effect. If the coking process proceeds too quickly, or if the heat is irregular, the desulphurization of the coke is apt to be less complete. In these matters much depends upon the skill and judgment of the burner.

Sulphur in By-Product Coking.

In the by-product oven, which is essentially a true distillation process, the heat being applied externally and no air supplied to the oven itself, the sulphur is distilled from the pyrite as atomic sulphur, as previously explained, but apparently it afterward combines with the hydrogen of the coal gas, forming sulphuretted hydrogen (H_2S); for it is necessary to remove this before the gas can be used for domestic purposes. This is accomplished with hydrated oxide of iron, a by-product obtainable from mine-water purification.

Here again appears the fallacy of superheating beehive ovens to eliminate sulphur, for in by-broduct ovens, in which no air is admitted, there is more desulphurization of the coke than in beehive process. For example: Given a yield of 70% coke by the beehive process, and 75% by the by-product process, from coal carrying 1% sulphur, the respective problems are:

	Beehive Oven Per Cent.	By-Product Oven Per Cent.
Sulphur in coal.....	1.000	1.000
Sulpuur volatilized.....	0.428	0.428
Sulphur remaining.....	0.70)0.572	0.75)0.572
Sulphur in coke.....	0.817	0.763

The practical volatilization of sulphur in the beehive process is only 18.3%, while in the by-product it is 23.7%.

The preceeding applies to sulphur as pyrite. Any organic sulphur present remains, for the most part, in the coke. Any sulphates present, such as $CaSO_4$, are also unaffected by aeration. We know of cases in which the sulphur in the coke was as high, or even higher, than in the coal, from which it must be concluded that much of the sulphur in the coal was sulphate, or the so-called organic sulphur; or else the ash of the coal was rich in iron, lime and magnesia, for it is impossihle to produce low sulphur coke from the coal the ash of which is high in these elements.

The Effect of Quenching on Sulphur.

Everyone is familiar with oven practice in this country, quenching the coke by cupious quantities of water. In the beehive it is customary to "water out" in the oven itself, while in the by-product it is done outside. In beehive practice, it takes approximately 1,000 gallons of water to quench a 5-ton charge of coke, consuming $^3/_4$ hour. The by-product practice is much quicker, but external watering produces darker coke.

Theoretically, it would seem possible to remove considerable sulphur by the quenching process. We have already indicated how iron sulphide (FeS) is formed in the coking process. The action of water on it is, $FeS + H_2O = FeO + H_2S$, assuming that the coke is quenched externally. The odor of sulphuretted hydrogen is easily detected when quenching, and rust spots in the coke show the presence of iron oxide. The practical coke burner is always suspicious of what he terms "rusty coke," as it is an indication of high sulphur. The same thing occurs in quenching in the oven itself, as in beehive practice. Sulphuretted hydrogen (H_2S) is evolved, but, at the same time, the water, as steam, is decomposed by the carbon, $H_2O + C = CO + H_2$, which probably accounts for a part of the large percentage of carbon monoxide and hydrogen gas found in the gas from beehive ovens.

The desulphurization of coke by water cannot go far, as the coke mass cools quickly, and its structure prevents penetration of the water thrown on it. As the temperature is lowered, the reaction involved becomes too slow to be of practical benefit. Data as to the sulphur eliminated in this way are scarce, but our own experience leads us to the conclusion that only a very small percentage of sulphur is thrown off during quenching. Certainly there is only a few hundredths of 1% in favor of water-quenched coke in a coke averaging 1% sulphur.

It may not be generally known that addition of muriatic acid (HCl) to the water greatly facilitates the removal of sulphur during the quenching process. Its action on iron sulphate is positive at all temperatures, thus, $FeS + 2HCl = FeCl_2 + H_2S$. There was a time when the cost prohibited the use of this method, but with the depletion of our low-sulphur coking coals, it may in the near future, be a factor in the elimination of sulphur.

New Methods and Appliances.

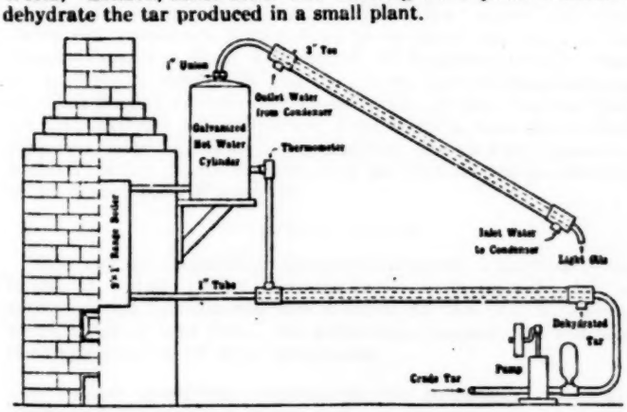
Gas and Temperature Conditions in Coke Ovens.—An important contribution to the literature of carbonization in coke ovens was lately made in *Stahl und Eisen* by Professor Oskar Simmersbach. The experiments were made in a Koppers regenerative oven, and the temperature conditions during the period of carbonization, and the composition of the volatile products were carefully determined.

The oven was charged with $8^3/_4$ tons of coal containing 22.7% of volatile matter, 6.32% of ash, and 12.1% of water; and yielded 79.86% of coke. The coal was carbonized for a period of 29 hours. The temperature rose gradually, the concluding readings being 1090° C. at one-fourth the distance from the charging side, 1120° C. in the center, and 920° C. at one-fourth the distance from the discharging side, taken in the center of the carbonized mass. In the gas space above the coal, the finishing temperatures were respectively 870°, 860°, and 810° C. The coke contained 88.53% of carbon, 2.56% volatile matter, and 8.91% ash.

Composition of the Gas during Carbonization (Per Cent. per Volume).

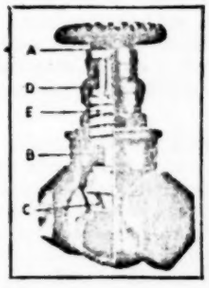
Hrs. Coal Carbonized.	2	3	4	5	6	7	8	9	10	11	12	13	15	17	19	21	23	25	27	Heating Gas
CO_2	3.30	3.0	2.3	2.5	2.2	2.00	1.40	1.90	2.30	1.30	1.50	2.00	1.90	1.80	1.10	1.05	0.80	0.7	1.0	2.1
C_6H_6	1.80	1.5	1.1	1.1	1.0	0.80	0.60	0.50	0.35	0.35	0.35	0.30	0.25	0.10	....	....	....	....	....	....
C_2H_4	4.00	3.5	3.1	3.2	2.8	2.50	2.50	2.00	1.75	2.05	1.85	1.80	1.80	1.90	1.20	1.00	0.60	0.3	0.3	1.8
O_2	1.05	0.8	0.6	0.6	0.5	0.50	0.20	0.20	0.20	0.10	0.20	0.20	0.15	0.25	0.15	0.05	0.05	0.1	0.3	0.6
CO	0.90	1.9	2.9	2.8	3.0	3.95	3.40	3.10	2.80	2.80	4.15	4.10	3.90	4.15	4.70	4.00	3.80	4 9	5.8	4.2
CH_4	36.65	36.1	34.5	34.5	33.6	32.40	33.65	33.45	31.20	32.40	33.40	32.45	33.20	30.60	26.10	21.15	18.95	12.2	4.7	26.2
H_2	42.50	44.6	48.8	47.8	50.1	50.75	53.75	50.55	47.10	51.50	50.65	49.75	53.40	51.60	55.75	58.95	61.90	67.0	70.0	51.7
N_2	10.00	8.6	6.7	7.5	6.8	7.10	3.60	8.30	14.30	9.50	7.90	9.40	5.40	8.60	11.00	13.80	13.90	14.8	17.9	15.4
Min. cal. power (0° C., 760 mm.), calculated per cubic meter...	5402	5271	5086	5071	4971	4802	4906	4797	4321	4583	4669	4530	4665	4369	3978	4487	3412	2960	2419	3964

A Small Tar Treating Plant.—A correspondent of the "Gas World," London, sends them this drawing of a plant erected to dehydrate the tar produced in a small plant.



It is built on the continuous distillation system, the crude tar pumped in at a rate found to give the result wanted; and the dehydrated tar, after pre-heating the ingoing tar, is discharged into a storage tank. This size plant is said to treat 10 barrels of tar a day, and produce about 20 gallons of light oil per ton of tar.

High Pressure Valve Without Packing.—Two special features of the high pressure valve shown in the cut, are the absence of of packing and the use of a cast iron spring. The springs, made under the Knudsen patent, have no temper, so that heat does not affect them, and test springs show no change in tension or resilience after having been in regular use for 3 years.



The non-rising hand wheel swivels on the shoulder *A* and is independent of the main valve stem. A square socket in the wheel turns a shank, the lower end of which fits over a square head on the main threaded spindle *B*, which moves up and down in the recess of the shank, as the valve *C* opens and closes. Between the rigid and revolving shoulders at *D*, is a grooved ring of bearing metal, which forms a constant seat and prevents the flow from rising above it. The purpose of the spring *E* is to maintain a tight contact with the grooved ring. The spring was tested to 10,000,000 deflections in a machine and showed no set, calipering the same before as after the test.

The valve is designed for use with high pressure steam, water, gas and air, and for ammonia.

This application of cast iron is novel.

Items of Interest from Various Localities.

THE Gas Appliance Division, of the Consolidated Gas Electric Light and Power Co., Baltimore, Md., under Mr. H. K. Dodson, has made a record for February that will startle some of the conservatives. The result of the first six days of work in February shows sales of 368 ranges and water heaters; the total for the same period a year ago was 128. One of the reasons for the increase was the full page newspaper advertising, announcing that the first payment on all ranges and water heaters, purchased during February and March, would not be due until April.

IN a special report on gas meter testing the Massachusetts Gas and Electric Light Commission, recommends that the sealers of weights and measures in cities and towns be made deputy inspectors, to inspect meters that have been complained of. "Gas is measured more accurately than the majority of articles of household consumption," says the board.

W. A. LEUENBERGER, Superintencent of the Tacoma (Wash.) Gas Company, was chairman of one of the committees of the reorganized Commercial Club which recently succeeded in increasing the membership of that organization from something over 500 to nearly 3,000.

THE Employee's Association of the San Diego (Cal.) Consolidated Gas and Electric Company recently elected officers as follows: J. E. Hayes, president; W. H. Ellison, vice-president; H. W. Elder, secretary-treasurer; H. E. Brunkow, assistant secretary-treasurer, and W. J. Wheeler, sergeant-at-arms. The new board of directors will consist of C. D. Weiss, W. A. Lambert, Bert Peck, George Day and W. Folcke.

EFFECTIVE February 1st, Mr. John C. D. Clark severed his connection with the Utah Gas and Coke Company, Salt Lake City; and Mr. Charles M. Eyman has been appointed general manager, and Geo. E. Smith, assistant manager of the company. Mr. Eyman was for several years manager of the Boise Gas Light and Coke Company, Boise, Idaho, going to Salt Lake in 1915, as assistant manager. Mr. Smith has been auditor of the Utah Gas and Coke Company for the past 4 years. The gas works at Salt Lake City will be under the supervision of O. W. Mattison, superintendent.

THE Pueblo (Col.) Gas and Fuel Company recently inaugurated a contest among its customers for the best reasons for using coke as fuel. Prizes of 5, 3 and 1 ton of coke were offered. There were 210 contestants, the judges being the heads of two local fuel companies. Five of the contestants broke into poetry to express their views, one of them, both pithy and pertinent, reads:

"Less cash and greater heat,
No smoke or soot—house neat,
Not a blowout—disposition sweet."

THE financing of the Sheridan (Wyo.) Gas Company has been completed, and an acceptance bond of $5,000 filed with the city council. Contracts for material have been made, subject to delivery in March and April. Construction work will begin as soon as spring opens, and will be pushed, so that they will have at least 14 miles of mains ready for gas by September.

THE probability of a considerable increase in business for the Knoxville Gas Company, operated by Henry L. Doherty & Company, was reported by V. L. Board, rate engineer, on his return from Tennessee. The Fulton Company, of Knoxville, which manufactures steam specialties, is now buying about 300,000 cubic feet of gas a month, and with the erection of a new $500,000 plant, expects to use about 1,250,000 cubic feet every 30 days, if satisfactory rates can be arranged.

AT the annual meeting of the stockholders of the Watertown (S. D.) Gas Company the following were chosen officers for the ensuing year: M. R. Baskerville, president; H. A. Park, vice-president; H. S. Fletcher, secretary and treasurer. The election for directors resulted in the choice of M. R. Baskerville, H. M. Finnerud and H. A. Park. The repairs necessary to make at the plant, as a result of the recent fire, were taken up and outlined.

THE volume of gas manufactured and sold in Philadelphia last year was 2,683,127,180 cubic feet, a decrease of 65,559,070 cubic feet as compared with the operations in the previous year. The revenue received from the United Gas Improvement Company annually since the provisions of the lease went into effect, 18 years ago is as follows:

Year.	Rate paid on each $1 collected	City's share.
1898	10 cents	$193,633.31
1899	10 "	340,193.73
1900	10 "	375,434.85
1901	10 "	416,449.72
1902	10 "	476,284.15
1903	10 "	636,859.95
1904	10 "	650,683.62
1905	10 "	668,887.83
1906	10 "	707,523.14
1907	10 "	758,929.23
1908	15 "	996,184.43
1909	15 "	1,173,110.03
1910	15 "	1,248,812.04
1911	15 "	1,304,028.78
1912	15 "	1,369,966.60
1913	20 "	1,846,976.60
1914	20 "	1,984,117.24
1915	20 "	1,946,870.77
Total		$17,094,946.02

A New York assemblyman has introduced a bill at Albany to compel gas companies to credit consumers of gas on their month's bill with the compound interest earned on sums deposited with the company when making applications for service. According to the assemblyman the companies receive compound interest on such sums, while the consumer receives only simple interest on the return of his money.

THE food baking contest held Feb. 5th by the Gardner (Mass.) Gas, Fuel and Light Company, brought out some fine articles of food. The contest proved interesting, as there were more contestants than usual, and the large audience had the pleasure of seeing how the food was judged. The winners for the best Washington pies were Mrs. W. N. Burgess, first prize, and Mrs. A. J. Lloyd second prize.

JOHN T. YOUNG, vice-president and general manager of the Grand Rapids (Mich.) Gas Light Company, was re-elected vice-president and a director of the Muskegon Gas Company. A. P. Lathrop, of New York, continues on the directorate. John Q. Ross is the new president of the Muskegon company.

RICHARD C. FOWLER is the new commercial manager of the Detroit City Gas Company, and William H. Kratzer has been named assistant commercial manager. The promotions, effective at once, were announced by V. F. Dewey, vice-president and general manager, following the resignation of Alonzo P. Ewing. Mr. Fowler has been advertising manager of the company the last five years; Mr. Kratzer has been in charge of the company's selling campaigns, and in his new position will have supervision of sales and advertising.

THE Galesburg (Ills.) Railway, Lighting and Power Company, will spend this year upwards of $225,000 in improvements of various kinds. These include the enlargement and the re-equipment of the boiler plant, the installation of a railway unit in the electric department, the replacement of many miles of gas mains, the installation of a new battery of boilers and necessary stoking equipment, the sinking of a deep well, extension of heating pipes and other auxilliary features.

ORDERS that meter readers employed by the gas companies in Los Angeles, Cal., will have to stand the loss if they make an incorrect reading of a consumer's meter, have been issued by President Fulton Lane of the City Board of Public Utilities. The order came as a result of consumers protesting against large bills being sent them and the gas company explaining that the meter reading had not been correct. President Lane stated that the accumulated

bill would not hereafter be allowed, but that the gas company must strike an average for three months, and render bills on this average, in the event the meter fails to register properly. In the event of an incorrect reading the meter reader must stand the loss.

THE Iowa Public Service Company, which owns and operates the gas plant at Ames, Ia., and furnishes the service for Navada, is in the process of reorganization, and is about to be taken over by the Appleby-Wagner Company, of Saginaw, Mich., which owns and operates the gas plants at Attica, St. Louis and Breckenridge, in Michigan, Johnson City, Tenn., and Waycross, Ga. The taking over of the Iowa Public Service Company's business will add considerably to their line of public utilities. It is the plan of the new concern to build a new plant at Ames, at a cost of approximately $35,000. Work is to be started about March 1. Messrs. Griffin, of Ames, and Tenny, of Newton, former owners, will retain an interest in the organization.

AT the annual meeting of the stockholders of the New Britain (Conn.) Gas Light Company, the following directors were chosen: Andrew J. Sloper, H. E. Russell, of New London; John Walsh, T. N. Stanley, F. M. Travis, of Norwich; Harold T. Sloper and Robert S. Brown. E. N. Stanley was elected auditor. The election of officers was postponed, as some of the directors were unable to attend.

THE employees of the Lexington and the Arlington (Mass.) Gas Companies enjoyed a socail evening Tuesday at the Arlington works on Grove street. The entertainment consisted of solos by Joseph Tole and dancing by Frank Ahern. Addresses were made by F. A. Woodhead, manager of the Arlington Gas Light Company, and by Mr. Dodd, from the Boston office. The affair was in charge of Messrs. E. J. Crowe, Edward Welsh and William McNamara.

THE Concord (N. H.) Light and Power Company has made plans for considerable extensions of its distribution mains, which eventually will carry the service into Penacook. This summer the mains of the company will be extended to West Concord, and next year the service will be carried into Penacook.

LEE and Lenox (Mass.) are to have $1.20 gas, supplied by the Pittsfield Coal Gas Company. When Pittsfield, which now enjoys $1 gas, gets a reduction Lee and Lenox will be given the same reduction per1000. Pipe laying is to begin just as soon as the condition of the ground permits and the work will consume substantially all summer. There are 20 miles of pipe to be laid, and one thousand customers, it is anticipated, will be served in Lee and Lenox.

MR. E. W. WAGNER has been appointed Acting Commercial Agent of the East Ohio Gas Company, Cleveland, O., succeeding F. R. Hutchinson.

AT a meeting of the directors of the Consumers Gas Company, Reading, Pa., John H. Keppelman was elected president, succeeding the late L. T. Custer. Mr. Keppelman will continue to act as superintendent, the honor just done him being an indication of how well he has filled the lesser position for more than 25 years. We add our congratulations to the hundreds sent him.

AN agreement between the village of Oak Park and the Public Service Company of Northern Illinois, providing for a new schedule of gas rates, has been approved by the Illinois Public Utilities Commission. The new schedule provides for an increase of 10 cents to $1.10 for the first thousand cubic feet, with $1 for all in excess to and including 3,000 cubic feet, and 90 cents for each additional 1,000. Permission is given patrons to have prepayment meters installed at the company's expense, and for gas purchased through these the price is to be $1.

Utilities Commission News.

CENTRAL NEW YORK COMBINATION WATER POWER CORPORATION.—Electrical corporations of central New York have applied to the up-State Public Service Commission for approval of the financial arrangements for one of the largest hydro-electrical developments in the State. A plant is proposed to be built at Seneca Falls to furnish current to the Central New York Gas and Electric Company and the Empire Gas and Electric Company, serving the cities and villages of Wayne, Ontario, Seneca and adjoining counties.

The Seneca Power Corporation, which will install the new station at Seneca Falls, asks to increase its capital stock from $5,000 to $1,600,000, and to issue $450,000 bonds. When the plant is completed it will be leased to the Central New York Gas and Electric Company, the lease guaranteed by the Empire Coke Company, which owns both of the distributing companies that will take the new power. Much of the money raised from this issue of securities will be expended for real estate and water rights. These include the land formerly owned by Murray G. Hoskins, and now a part of the barge canal property. The water, power and other rights and easements proposed to be acquired are those of the Rumsey Pump Co., M. J. Fritz and H. W. Douglass,trustees; Chester A. Braman, Roberts Milling Co., Ivory Button Manufacturing Co., Cast Thread Fittings and Foundry Co., Empire Gas and Electric Co., National Advertising Co., Fred Maier & Sons, Seneca Falls Manufacturing Co., Edward H. Palmer, Seneca Falls Paper Co., Josiah T. Miller, Sarah F. Allen, and the trustees and bondholders of the Seneca Falls Woolen Co.

NEW JERSEY COMMISSION RECOMMENDATIONS.—The New Jersey Board of Public Utility Commissioners, in its annual report reaffirms certain recommendations it made to the last legislature, which failed to heed them. The commission suggests the following to the governor as of great importance:

1. An act specifically empowering the commission to require proof when its approval of proposed security issues is asked that there has been an adequate attempt on the part of the petitioners to ascertain and to obtain the highest price at which securities may be sold, and in default of satisfactory proof thereof to impose as a condition of granting such approval the advertising for sealed competitive bids for such securities, accompanied by certified checks guaranteeing the responsibility of the bidders.

2. An act making void all security issued by public utilities, whether put out by way of sale or by way of pledge or hypothecation, and making such unauthorized issuing a misdemeanor, unless the prior approval of the board thereof has been granted.

3. An amendment of the general railroad act, and in particular Sec. 70 thereof, whereby the limitations to be imposed upon the bonded debt that may be incurred by a railroad company incorporated in New Jersey by a foreign corporatian as regards its property situate in this State may be made uniform, whether said company is operated independently or under lease, or by virtue of merger or consolidation with another railroad company.

4. Legislation prescribing more precisely the terms under which railroad companies or other public utilities may lease or be leased to railroads or other public utilities, such legislation to fix the maximum term of the lease and to make mandatory the requirement that the property of the lessor company shall be at all times capable of identification either physically or by fixing the value thereof upon the books of said lessor company and lessee company, respectively.

MUNICIPALITIES MUST COME UNDER COMPENSATION ACT.—All Michigan cities must come under the workmen's compensation law, according to a decision of the Supreme Court. The city of Detroit questioned the State's right to force a municipal corporation to accept the compensation law and permit a private one to stay out if it so desired. Sault Ste. Marie insisted that the law made no provision for the paying of an award by a municipal corporation, and did not supersede the city charter. Both cities lost their cases. In the Detroit case, a dependent of a city employee, who was killed while working in the city lighting department, was awarded compensation. The Justice pays particular attention to the assertion of counsel that under the constitution of 1909 Detroit may enjoy the so-called private capacities granted to it, like a private corporation, and, therefore, in such activities as public lighting, the city is a private corporation and not a municipal one. On this question Justice Ostrander says; "Such so-called private municipal activity is public activity nevertheless."

Financial Notes.

AMERICAN GAS AND ELECTRIC COMPANY is selling an issue of $1,079,000 of 6% cumulative preferred stock at par, $50, and accrued dividend. The proceeds from the sale are to be used for extensions and additions to subsidiary companies. The combined statement of earnings for the 12 months ended November 30, 1914, and 1915, follows:

	1914.	1915.
Gross earnings of all subsidiary companies	$4,305,604	$4,938,478
Balance of subsidiary companies' earnings, after all deductions, applicable to American Gas and Electric Company.	1,004,823	1,284,724
Other income of American Gas and Electric Company	456,436	457,717
Total gross income applicable to American Gas and Electric Company.....	$1,461,259	$1,742,441
Total expenses and interest charges of American Gas and Electric Company...	679,607	711,456
Balance.....	$781,652	$1,030,985

BROWN, Lisle & Marshall recently acquired a block of Pawtucket Gas 5% preferred stock, to be placed among their customers. A large part of it has been so placed, at $98 and accrued dividend, the investment yield being 5 1/8%. The PAWTUCKET GAS COMPANY of New Jersey owns the entire capital stock of the Pawtucket Gas Company of Rhode Island, and is an underlying company of the Blackstone Valley Gas and Electric Company.

THE total gross earnings of the ST. PAUL GAS LIGHT COMPANY for 1915, were $2,220,037.02, and the gross earnings tax to be paid to the city, on the 5% basis, was $111,001.85. The real and personal taxes paid by the company for 1915, bring its total taxes up to $221,483.40. The net earnings for 1915 were $288,323.44 on a paid up capital of $4,350,000, and bonds of $5,000,000. The total assets are $10,146,169.96. The total cost of the plant in St. Paul on January 1, 1916, is given as $9,692,511.14, including about $295,000 expended in 1915 for additions, new machinery, mains and other equipment. In spite of the lower rates for 1915, as compared with 1914, the gross earnings from sales of gas were $1,237,302.16, as against $1,162,300.97 in 1914, an increase of about $75,000. The gross earnings from the electric plant also increased from $829,653.27 to $927,290.27 in 1915. The total cost of operation and maintenance in 1915 was $1,931,713.58, of which the largest item was for raw materials and products, $607,000; $326,- was paid for labor and salaries, and $273,000 for interest. Repairs cost $303,000. The number of persons served with gas was 40,778, and with electric current, 13,668. Of the 43,500 shares of stock 43,493 are owned by the American Light and Traction Company, the remaining seven shares being owned, one each, by the following: A. P. Lathrop, New York; C. L. Kluckhohn, E. A. Young, Paul Doty, Kenneth Clark, G. H. Prince and J. B. Crowley, all of St. Paul.

UNION Heat, Light and Power Co., owned by the Cincinnati, Newport and Covington Light and Traction Co., a subsidiary of COLUMBIA GAS AND ELECTRIC CO., will refund its $1,608,000 4% bonds by an issue of 5% bonds. The company some time ago authorized an issue of $5,000,000 5% 50-year bonds to provide for additions and betterments and for refunding. A. B. Leach & Co., bankers for Columbia Gas and Electric, have now advised holders of the 4% bonds that by arrangement with Union Heat, Light and Power Co., they are ready to exchange the new 5% bonds for the 4% issue bond and pay a cash difference of 1% on the face value of each bond. The 4% bonds mature May 1, 1918, and are quoted at 96 1/4. As soon as these bonds are retired the 5% bonds become a first lien on all the property of Union Heat, Light and Power Co. There have been $101,000 of the 5% bonds issued. The company controls the lighting and power franchises in Covington, Newport and other Kentucky suburbs of Cincinnati.

BALTIMORE GAS APPLIANCE CO., controlled by interests associated with Consolidated Gas, Electric Light and Power Co., is arranging to retire all its bonds and prior lien stock. This will be accomplished by the sale of $150,000 preferred and $100,000 common stock. The new stock will be sold in blocks of one share of preferred and one share of common stock and the new offering will be underwritten.

THE LACLEDE GAS LIGHT COMPANY reports a gross income of $4,577,731 earned in 1915, a decline of $51,958 from the previous year. Economies in operation enabled the concern to save as net earnings, $2,231,382, a gain of $125,800, and the surplus of $989,215 after interest and prefered stock dividends, was equal to 9.25% on the common stock. In 1914 the common stock surplus was 8.20%. President C. L. Holman says in the annual statement that gross earnings declined largely because of the business depression of much of the year. Advantageous contracts, covering the purchase of raw materials, and the sale of by-products, he added, were factors in reducing manufacturing costs. During the year $1,432,522 was spent on new construction, and $359,498 was set aside for depreciation and contingencies, the latter being $80,978 more than the year before.

CONTENTS.

*GAS FIRED, HOT AIR, CIRCULATING HEATERS, by MR. H. Thuston Owens.... 113
THE ORIGIN OF ENGLISH MEASURES OF LENGTH, by Sir Charles M. Watson..... 115
ONE CITY'S GAS BUSINESS..... 117
DIVERTED EFFORTS OF COMMISSIONS, by Wm. McClellan.. 118
DRUGS FROM COAL TAR..... 119
EDITORIALS..... 120
Forty-sixth Annual Meeting, New England Association of Gas Engineers—I. E. S. Tenth Anniversary, Mid-Winter Convention—Death of B. W. Perkins.
POSSIBILITIES OF HOUSE HEATING BY GAS, by W. H. Bradley.... 122
PUMPING CALIFORNIA CRUDE OIL..... 122
AN ANALYSIS OF OIL GAS TAR, by H. E. Brunkow..... 123
SEASONABLE DISPLAYS, by W. D. Stoddard..... 123
ACCIDENT PREVENTION IN THE CHEMICAL INDUSTRIES.... 124
NITRE-CAKE INSTEAD OF SULPHURIC ACID..... 124
SULPHUR IN COKE, by J. R. Campbell..... 124
NEW METHODS AND APPLIANCES... 125
Gas and Temperature Conditions in Coke Ovens—*A Small Tar Treating Plant—*High Pressure Valve Without Packing.
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 126
Baltimore Business—Praise the Meter—A Personal—San Diego Employees—Changes in Salt Lake City—A Coke Jingle—Sheridan Gas Co. Ready—A Big Prospect—Watertown, S. D., Doings—Eighteen Years in Philadelphia—Want Compound Interest—Baking Contest, Gardner—Some Muskegon Officers—Mr. Fowler and Mr. Kratzer Advanced—Galesburg Improvements Planned—To Pay for Mistakes—Iowa Public Service Company Re-organization—New Britain Elections—Lexington and Arlington Employees Social—Concord Main Extensions—Lee and Lenox Get Pittsfield Gas—A Personal—Mr. Keppelman Honored—Oak Park Rate Schedule.
UTILITIES COMMISSION NEWS..... 127
Central New York Combination Water Power Corporation—New Jersey Commission Recommendations—Municipalities Must Come Under Compensation Act.
Financial Notes..... 128
Public Lighting Table for Feb., 1916 (Ad. Section)..... 7
Southern Gas Association Bulletin (Advertising Section).. 19
Meeting Times of the Various Gas Associations (Advertising Section) 21